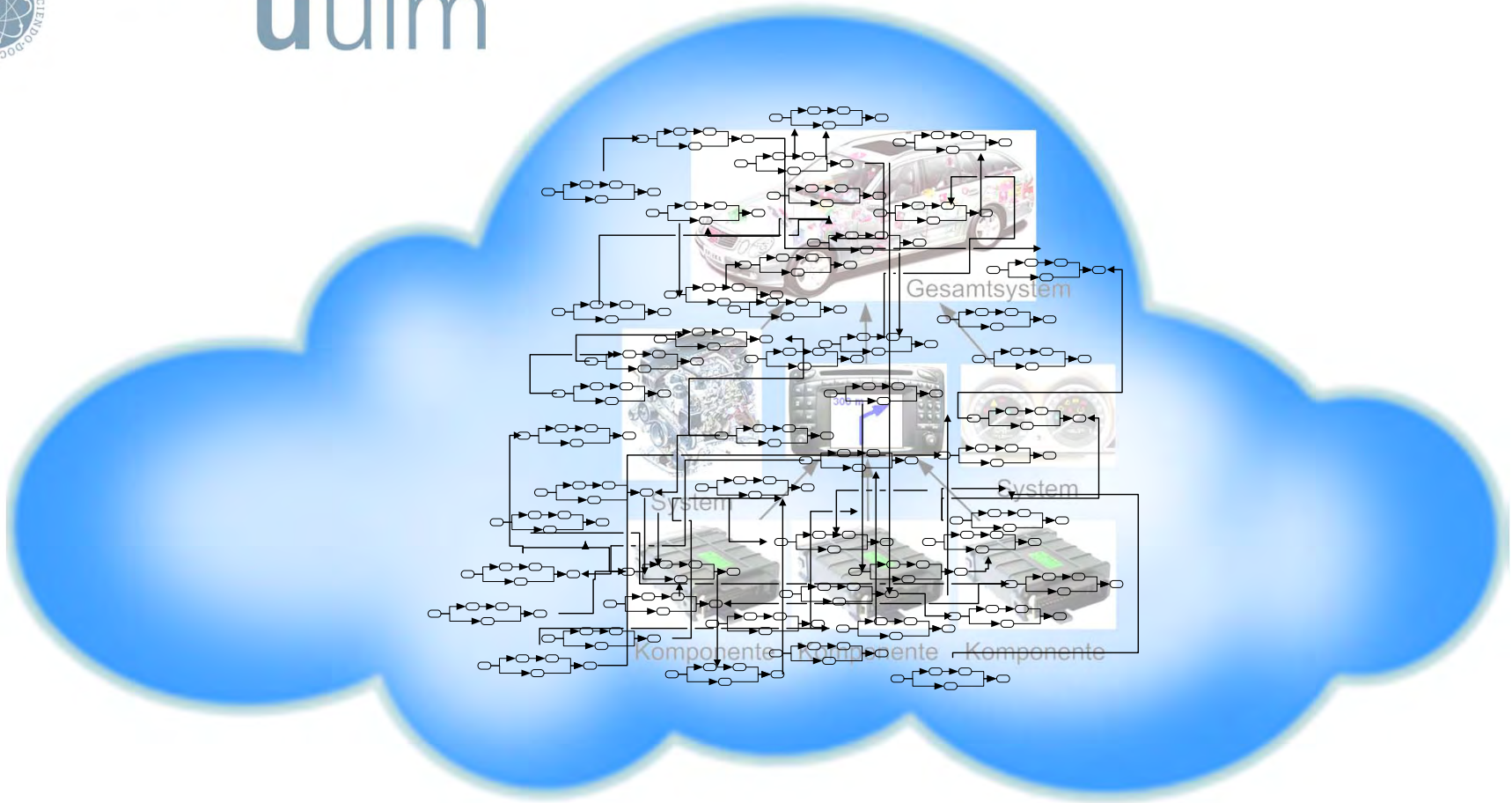
ulm university universität ulm

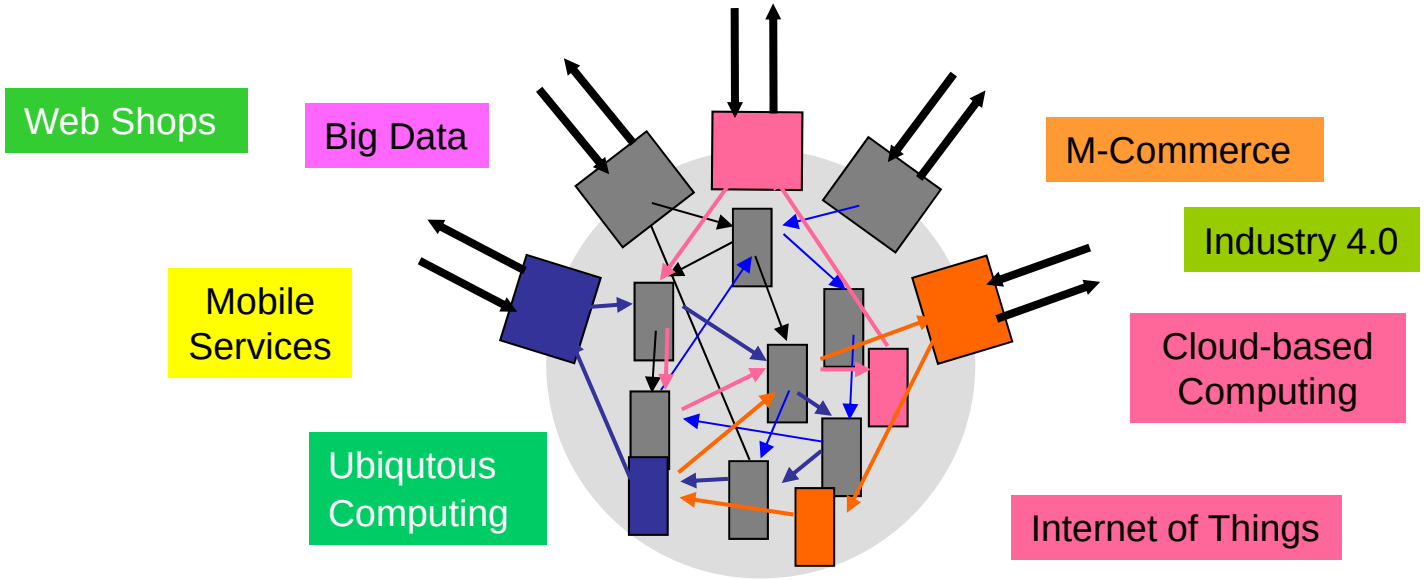


The Next Wave of Research in Business Process Management

Manfred Reichert

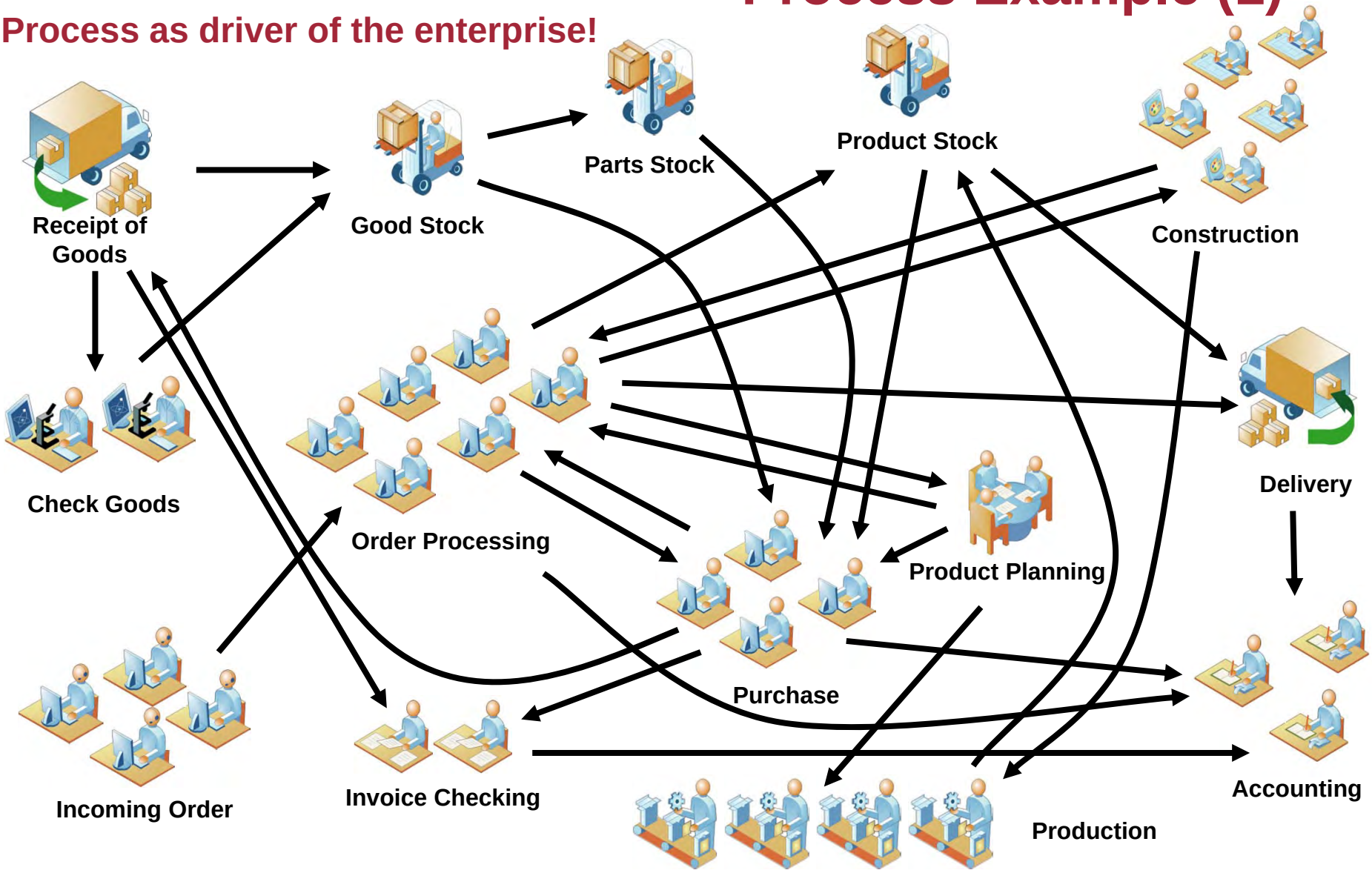
www.uni-ulm.de/dbis

Introduction:
The Agile Enterprise



Introduction:
Process Example (1)

Process as driver of the enterprise!



Introduction: Process Example (2)

Processes exist in all domains!

Registration

HIS

patient information

Orders Placed

examination orders

Orders Filled

RIS

procedure scheduled

Prefetch any relevant prior studies

modality worklist

Acquisition Modality

acquisition completed

images printed

images stored

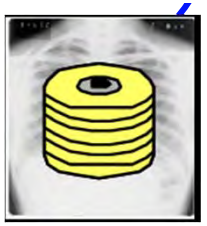


Image Manager & Archive

PACS

images retrieved

Diagnostic Workstation

Film Lightbox

Film Folder

Film

report

Report Repository

report

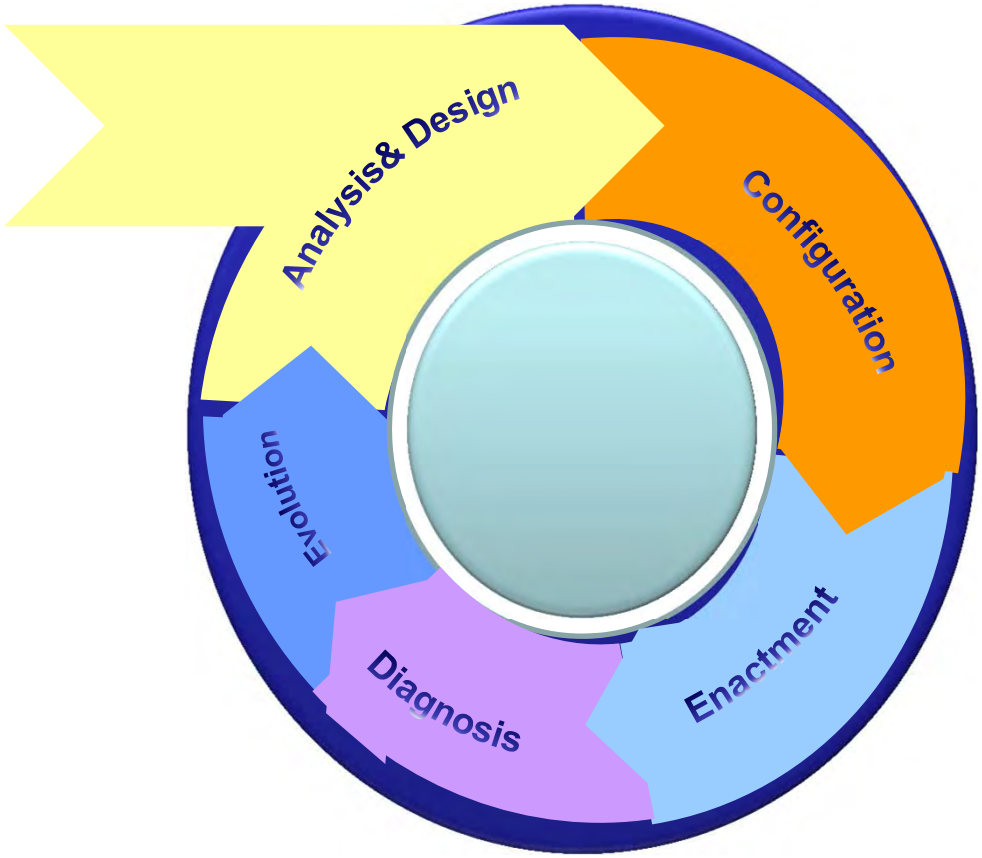
report

Introduction: What is BPM?

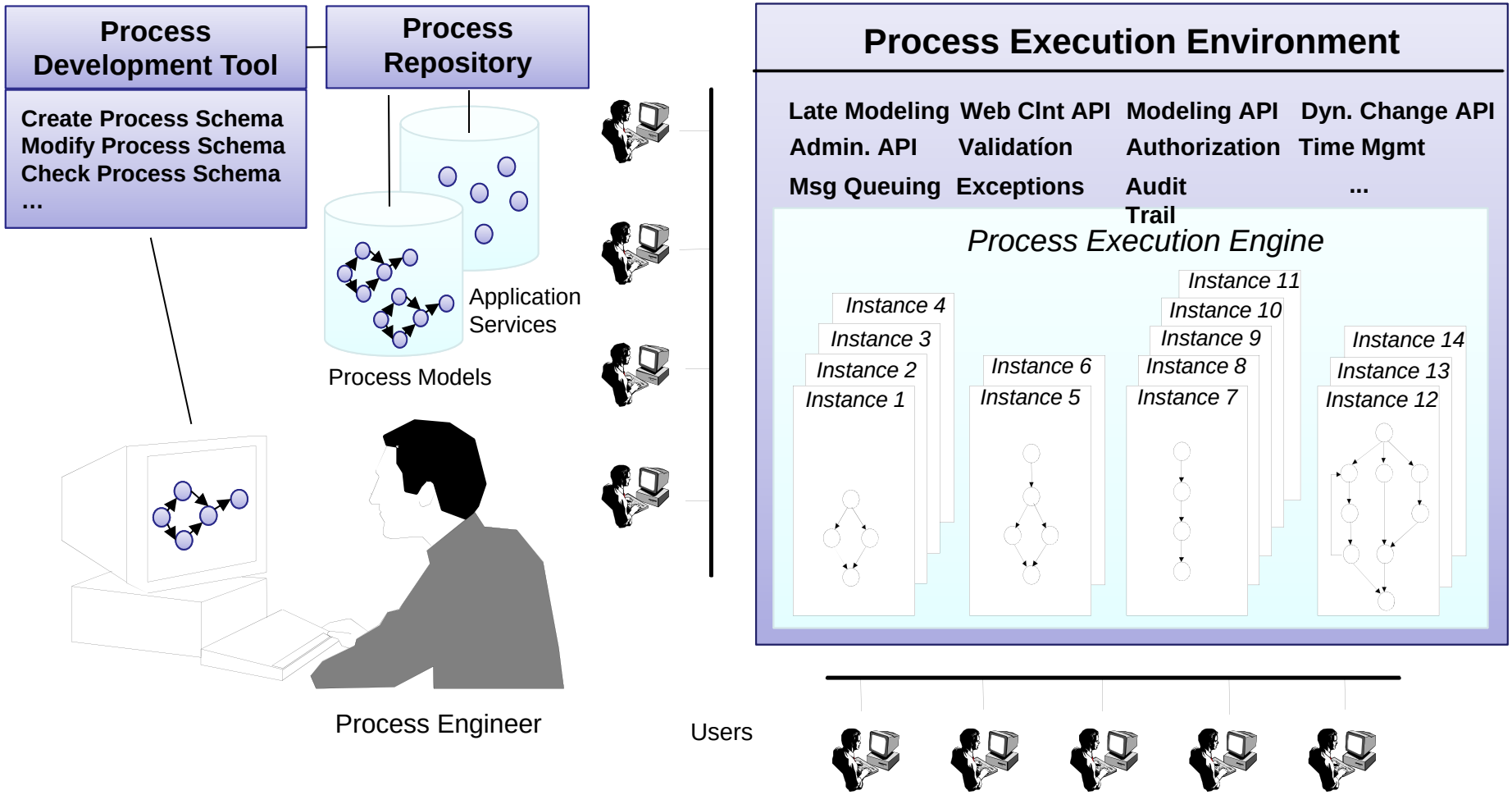
Business Process Management (BPM) is a **discipline**
involving any combination of
modeling, **automation**, **execution**,
control, **measurement**, and **optimization**
of business activity flows,
in support of enterprise goals,
spanning IT systems, employees, customers and partners
within and beyond the enterprise boundaries.

Source: K. Swenson, BPM'14 Keynote

Introduction:
BPM Lifecycle



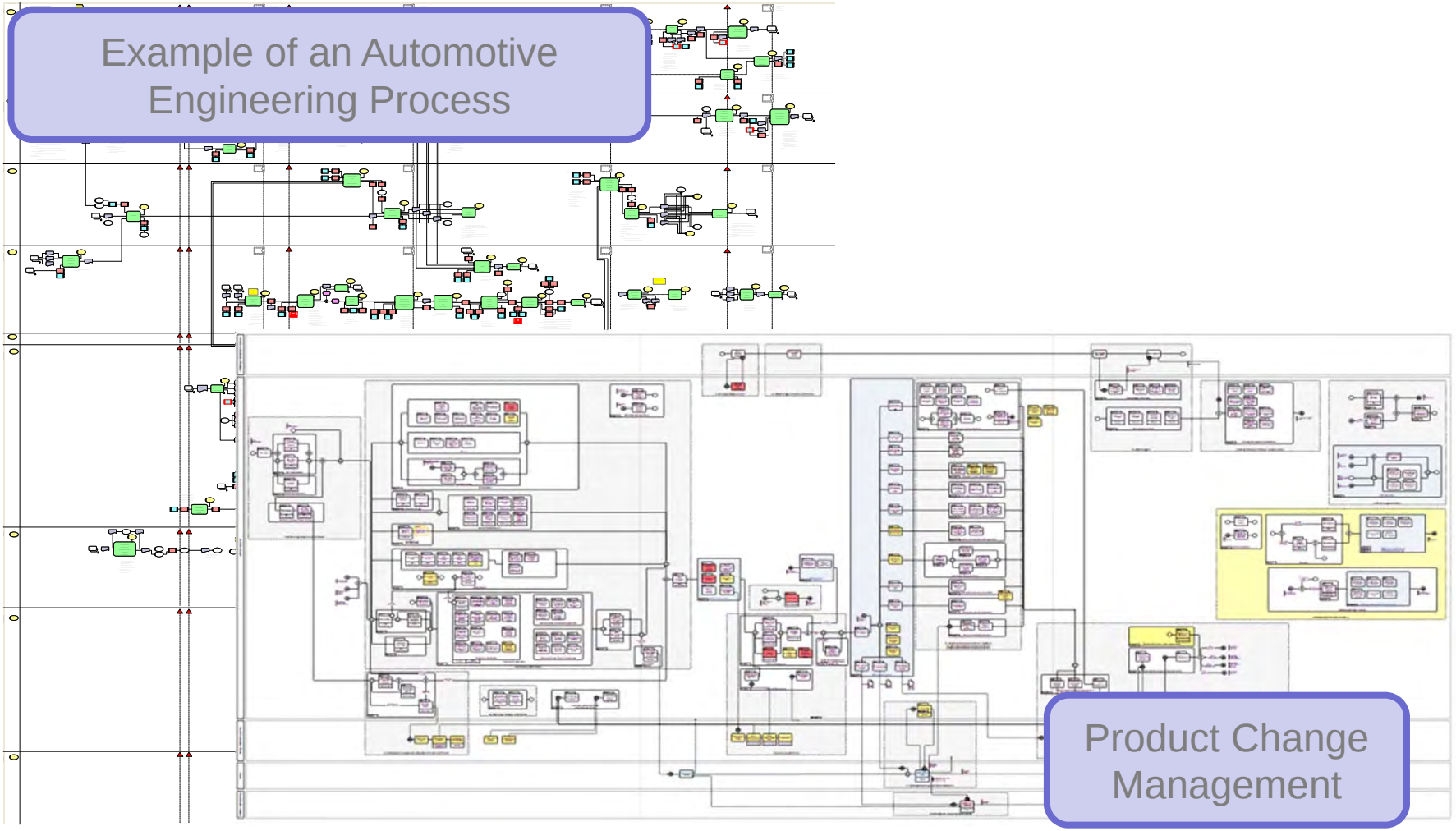
Introduction:
Process-Aware Information System



Introduction:
The Business IT Alignment Gap

Huge discrepancy between the potential and the actual support of business processes by IT systems!

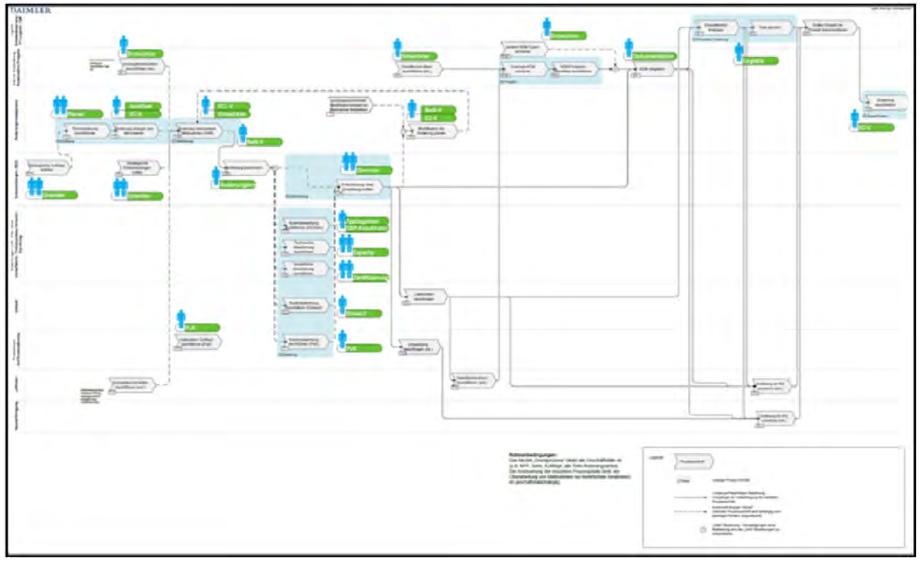
Real World Processes:
Large Process Models



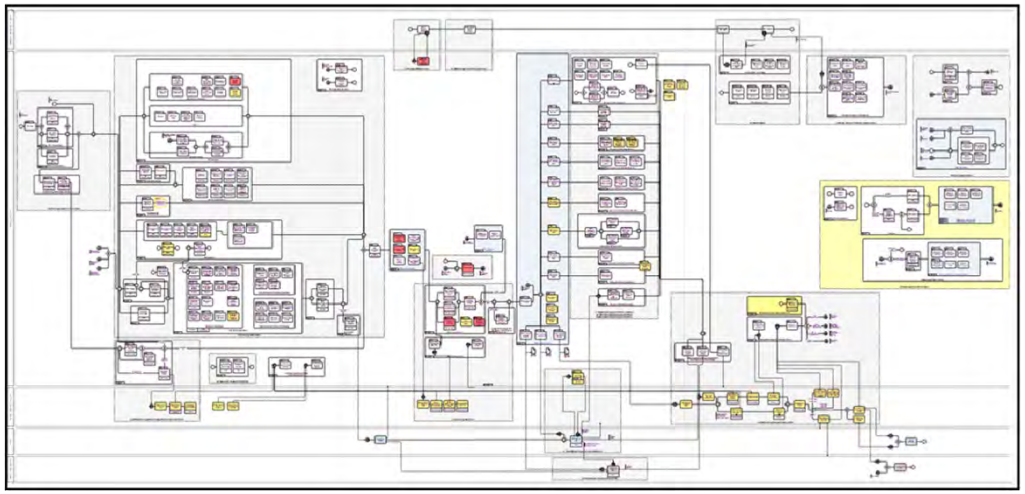
Real World Processes:
Missing Aligment of Models at Business and IT Level

Business Level

Model created by domain expert

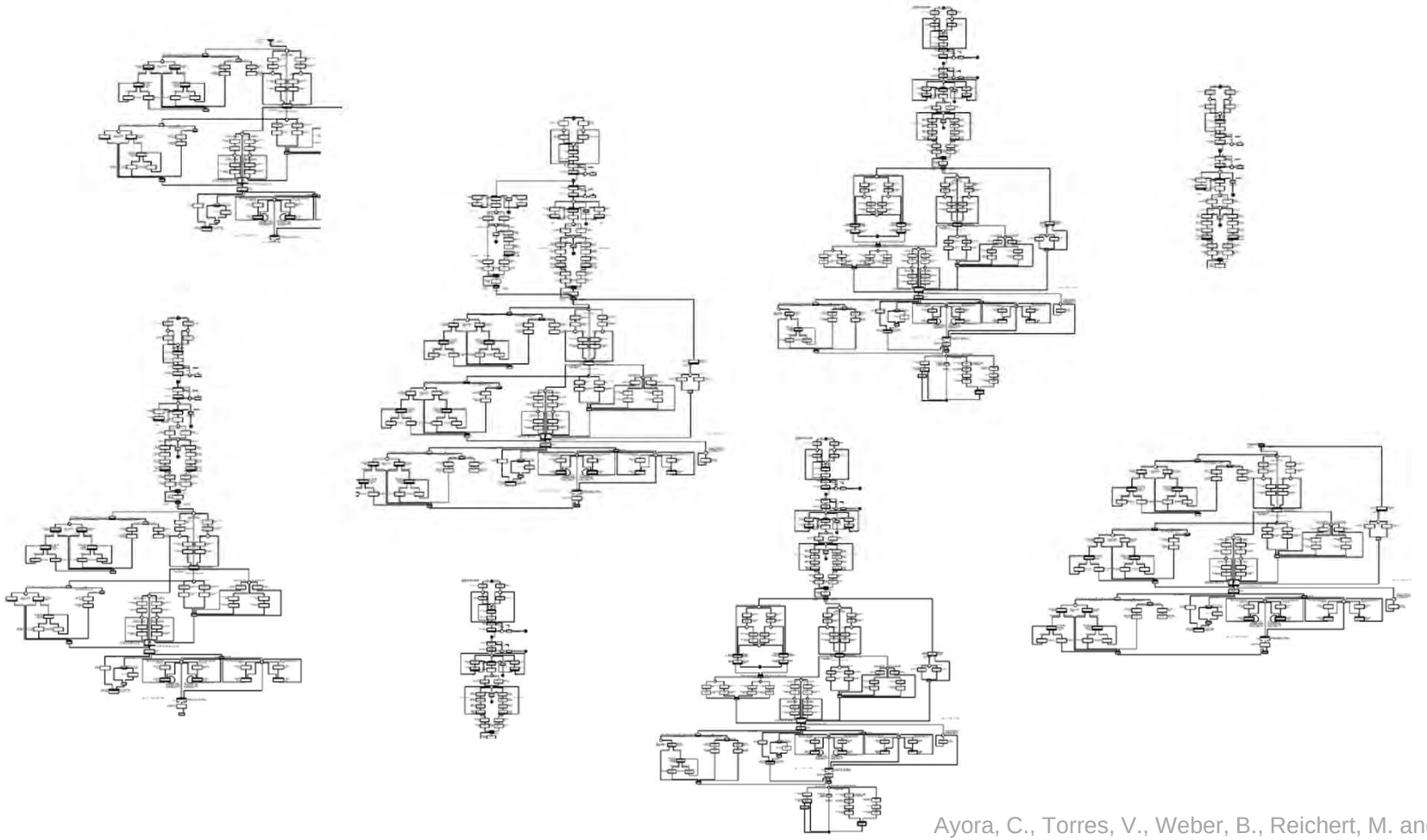


Model created by IT expert



IT Level

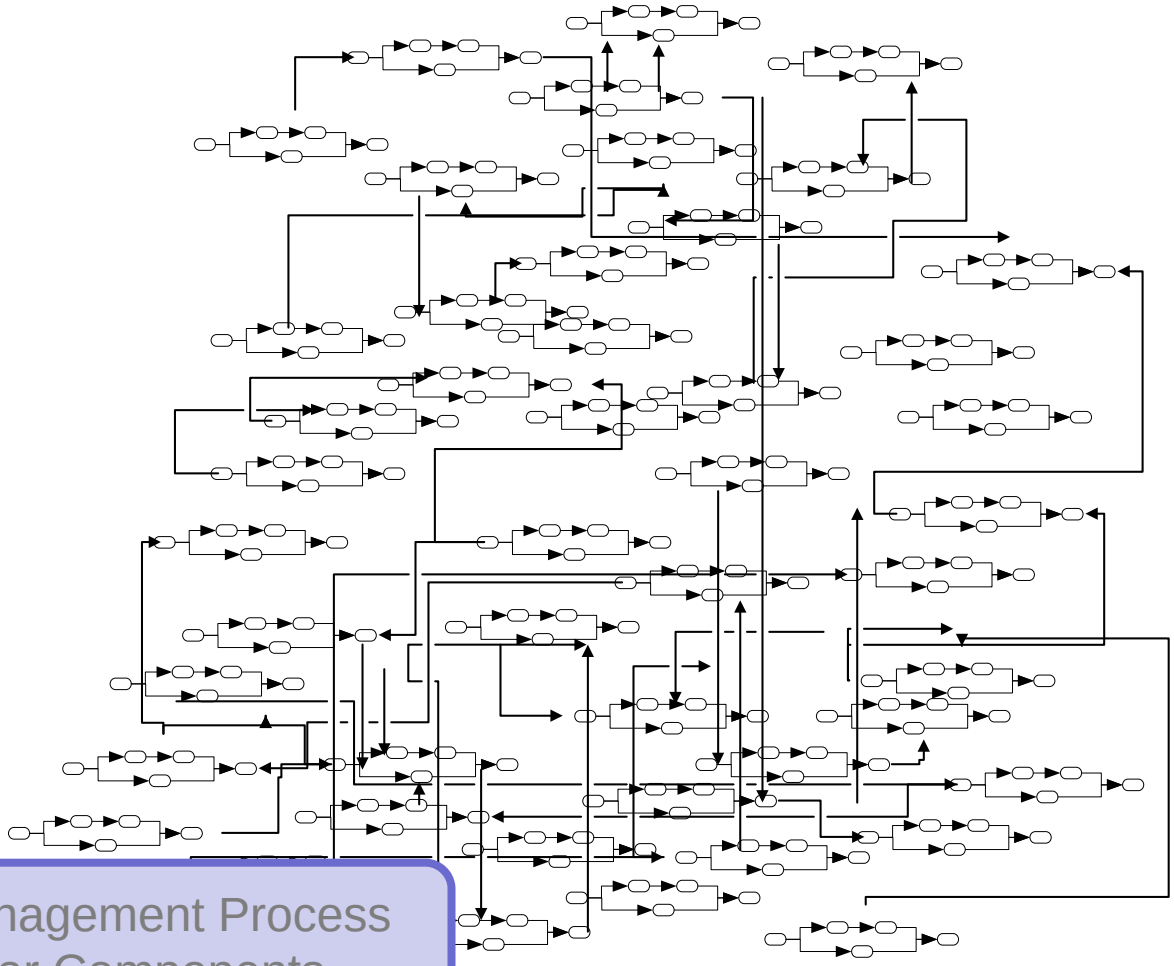
Real World Processes:
High Process Variability



[La Rosa et al]

Ayora, C., Torres, V., Weber, B., Reichert, M. and Pelechano, V. (2015) *VIVACE: A Framework for the Systematic Evaluation of Variability Support in Process-Aware Information Systems.* Information and Software Technology, Vol. 57, pp. 248-276

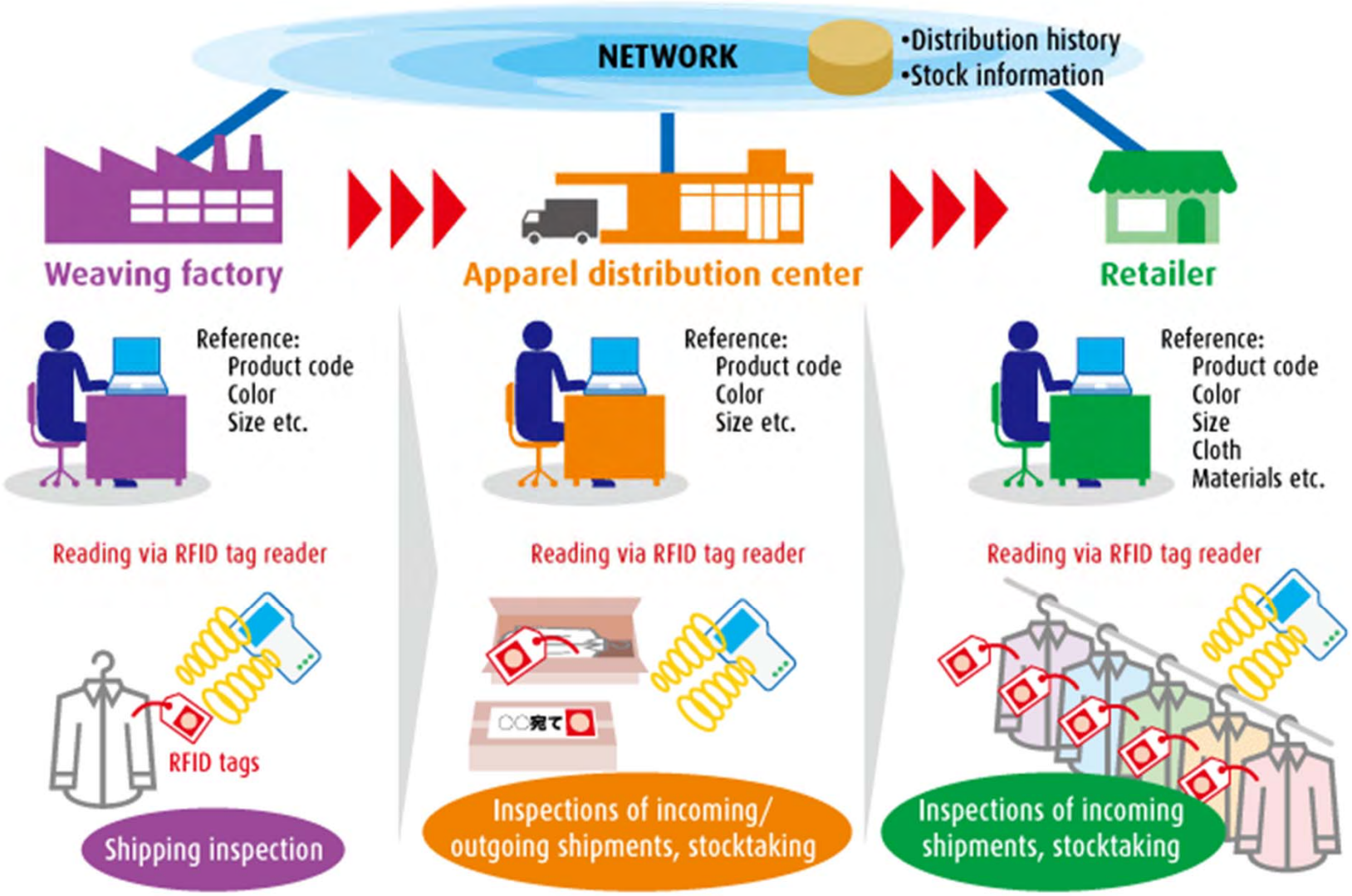
Real World Processes:
Large Collective Process Structures



Release Management Process
for E/E Car Components

D. Müller, M. Reichert, J. Herbst: A New Paradigm for the Enactment and Dynamic Adaptation of Data-Driven Process Structures. CAiSE 2008: 48-63

Real World Processes:
Intra- vs. Cross-organizatonal Processes



Real World Processes: Need for Different Levels of Process Support

❑ Routine processes

- Interdisciplinary cooperation among different people and organizational units to perform routine work

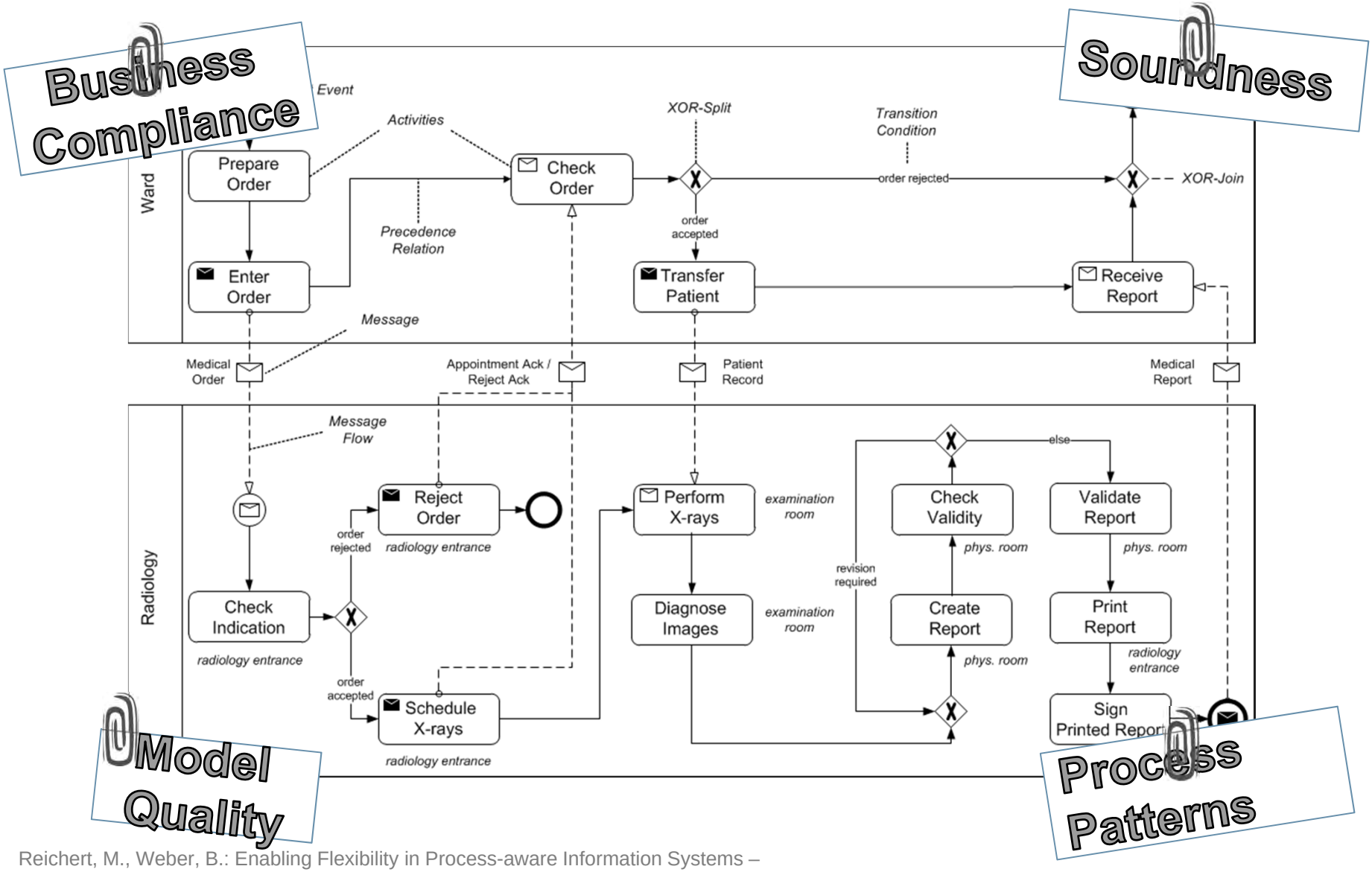
❑ Knowledge-intensive processes

- Guided by available information
- Dependent on domain-specific knowledge
- Uncertainty, goal-orientation, emergence of work, evidenced guidelines, …

N. Mundbrod, F. Beuter, M. Reichert (2015) Supporting Knowledge-intensive Processes Through Integrated Task Lifecycle Support. EDOC 2015

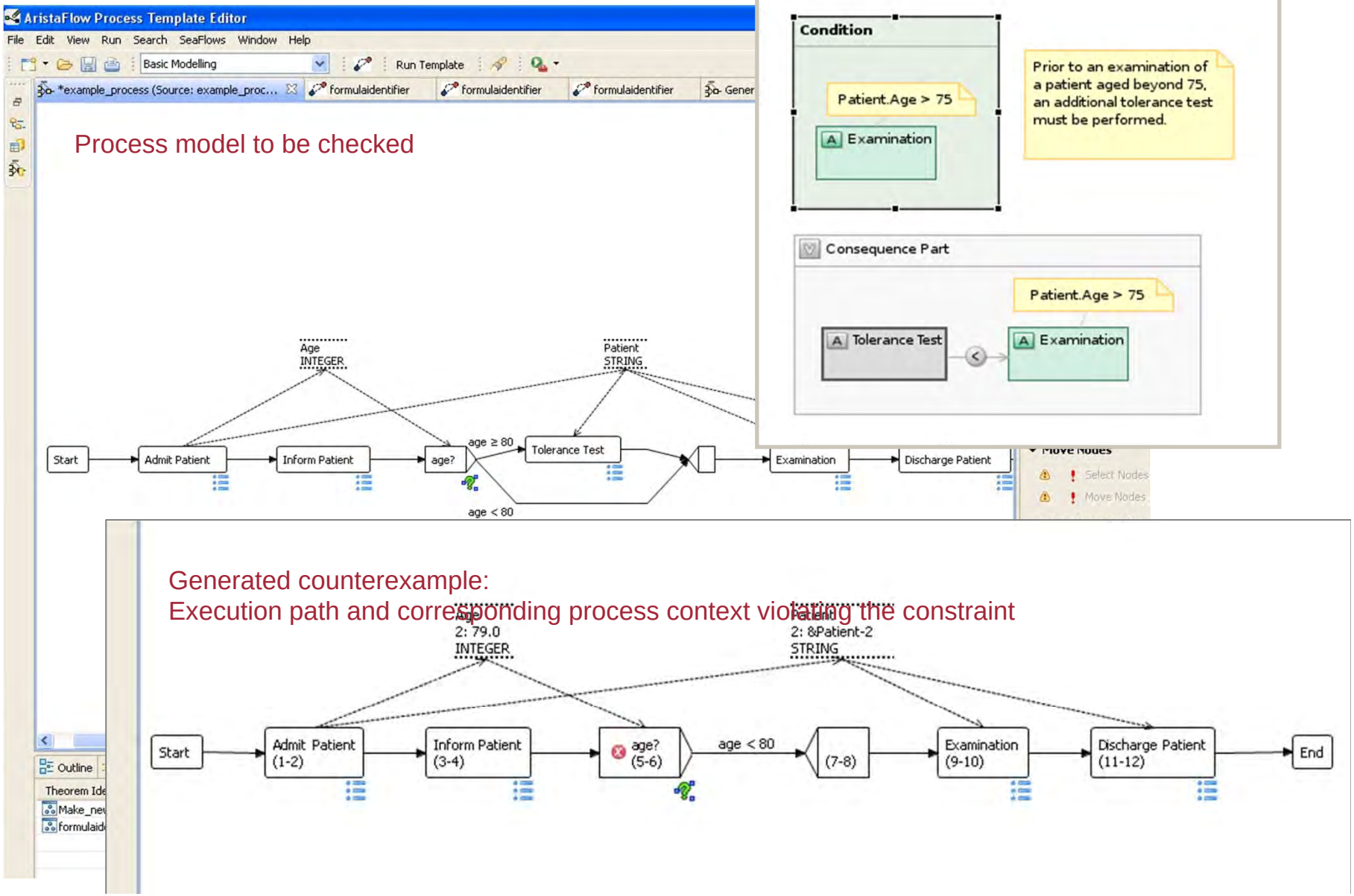
Lenz, Richard and Reichert, Manfred (2007) *IT Support for Healthcare Processes - Premises, Challenges, Perspectives..* Data and Knowledge Engineering, 61(1): 39-58, Elsevier.

Business Process Modeling

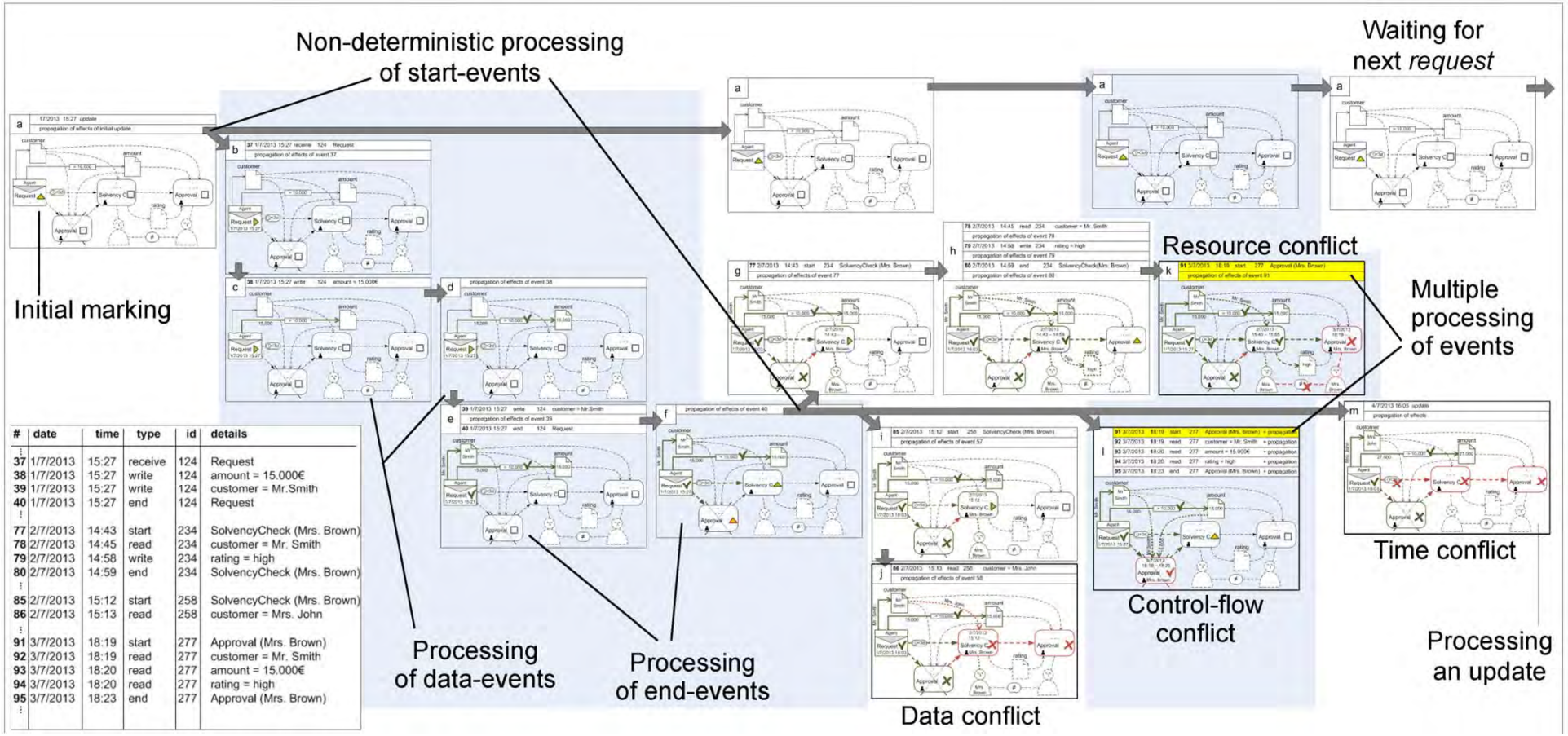


Reichert, M., Weber, B.: Enabling Flexibility in Process-aware Information Systems – Challenges, Methods, Technologies, Springer, 2012

Business Process Modeling: Compliance



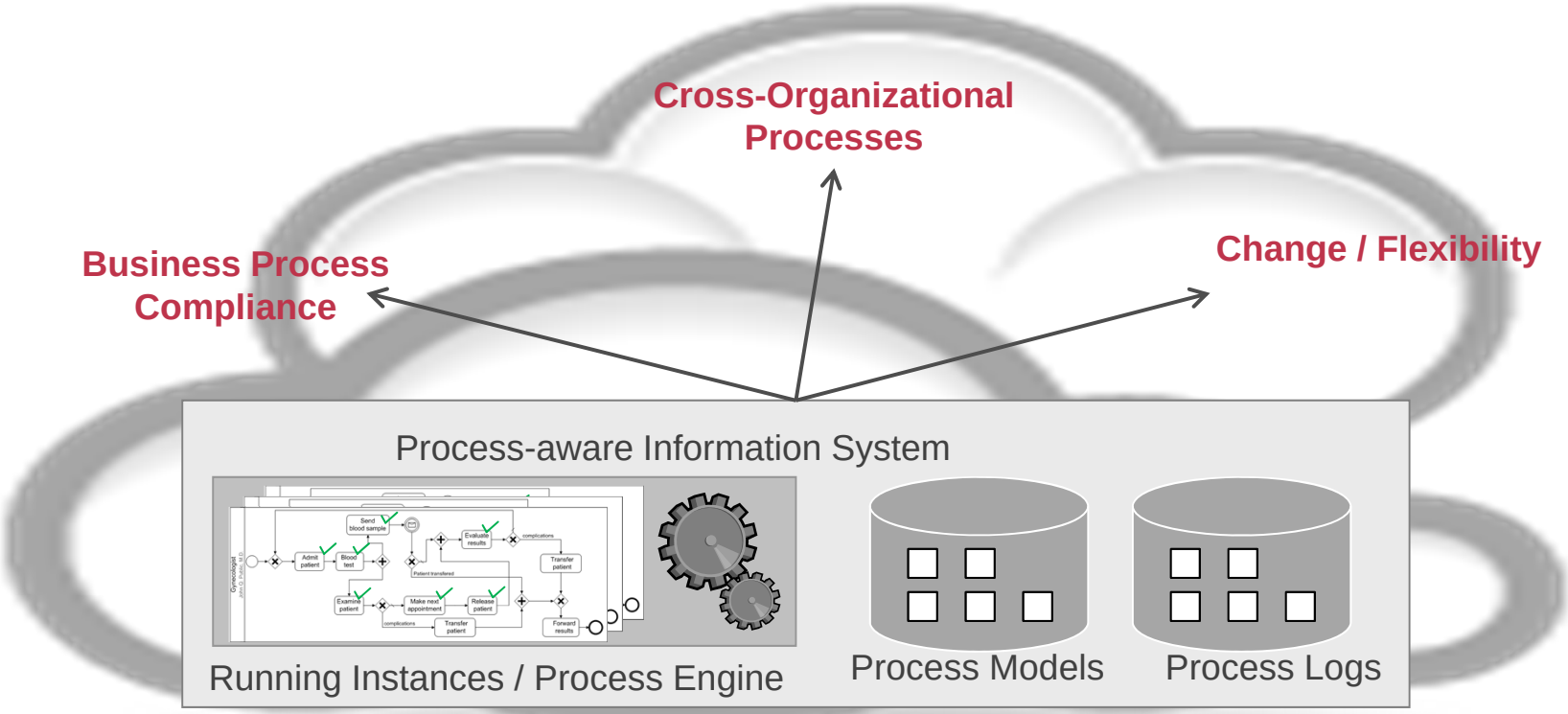
Process Compliance:
Modeling Multiple Perspectives of Compliance Rules



#	date	time	type	id	details
37	1/7/2013	15:27	receive	124	Request
38	1/7/2013	15:27	write	124	amount = 15.000€
39	1/7/2013	15:27	write	124	customer = Mr.Smith
40	1/7/2013	15:27	end	124	Request
77	2/7/2013	14:43	start	234	SolvencyCheck (Mrs. Brown)
78	2/7/2013	14:45	read	234	customer = Mr. Smith
79	2/7/2013	14:58	write	234	rating = high
80	2/7/2013	14:59	end	234	SolvencyCheck (Mrs. Brown)
85	2/7/2013	15:12	start	258	SolvencyCheck (Mrs. Brown)
86	2/7/2013	15:13	read	258	customer = Mrs. John
91	3/7/2013	18:19	start	277	Approval (Mrs. Brown)
92	3/7/2013	18:19	read	277	customer = Mr. Smith
93	3/7/2013	18:20	read	277	amount = 15.000€
94	3/7/2013	18:20	read	277	rating = high
95	3/7/2013	18:23	end	277	Approval (Mrs. Brown)

D. Knuplesch, M. Reichert, A. Kumar: Visually Monitoring Multiple Perspectives of Business Process Compliance. BPM 2015: 263-279

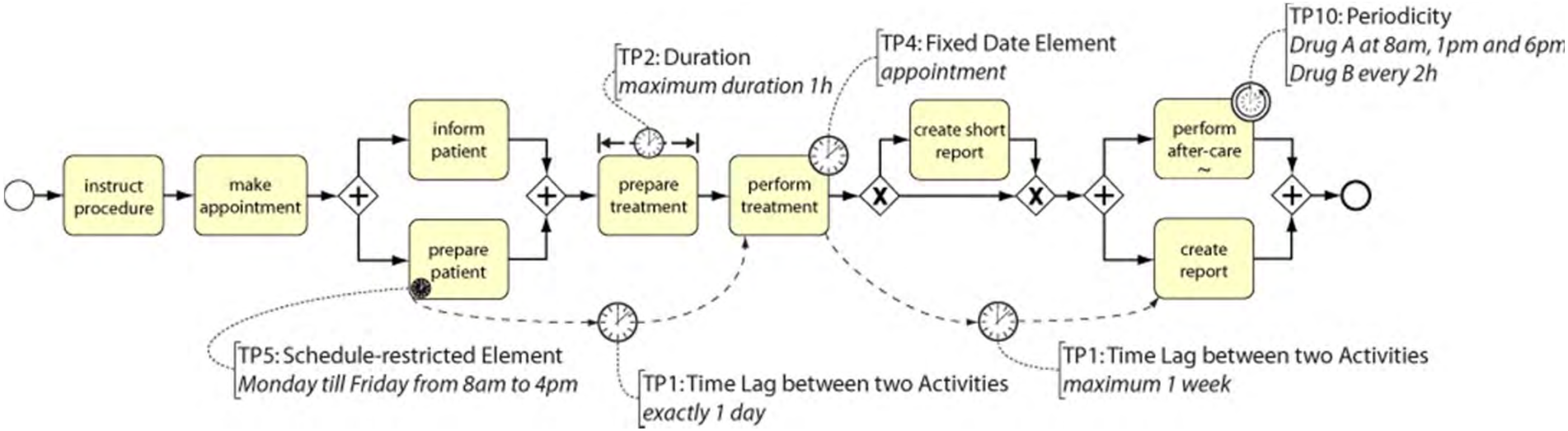
Process Compliance:
Ensuring Compliance for Cross-organizational and Evolving Processes



Fdhila, C. Indiono, S. Rinderle-Ma, M. Reichert: Dealing with change in process choreographies: Design and implementation of propagation algorithms. Inf. Syst. 49: 1-24 (2015)

D. Knuplesch, W. Fdhila, M. Reichert, S. Rinderle-Ma (2015) Detecting the Effects of Changes on the Compliance of Cross-organizational Business. ER 2015 (accepted for publication)

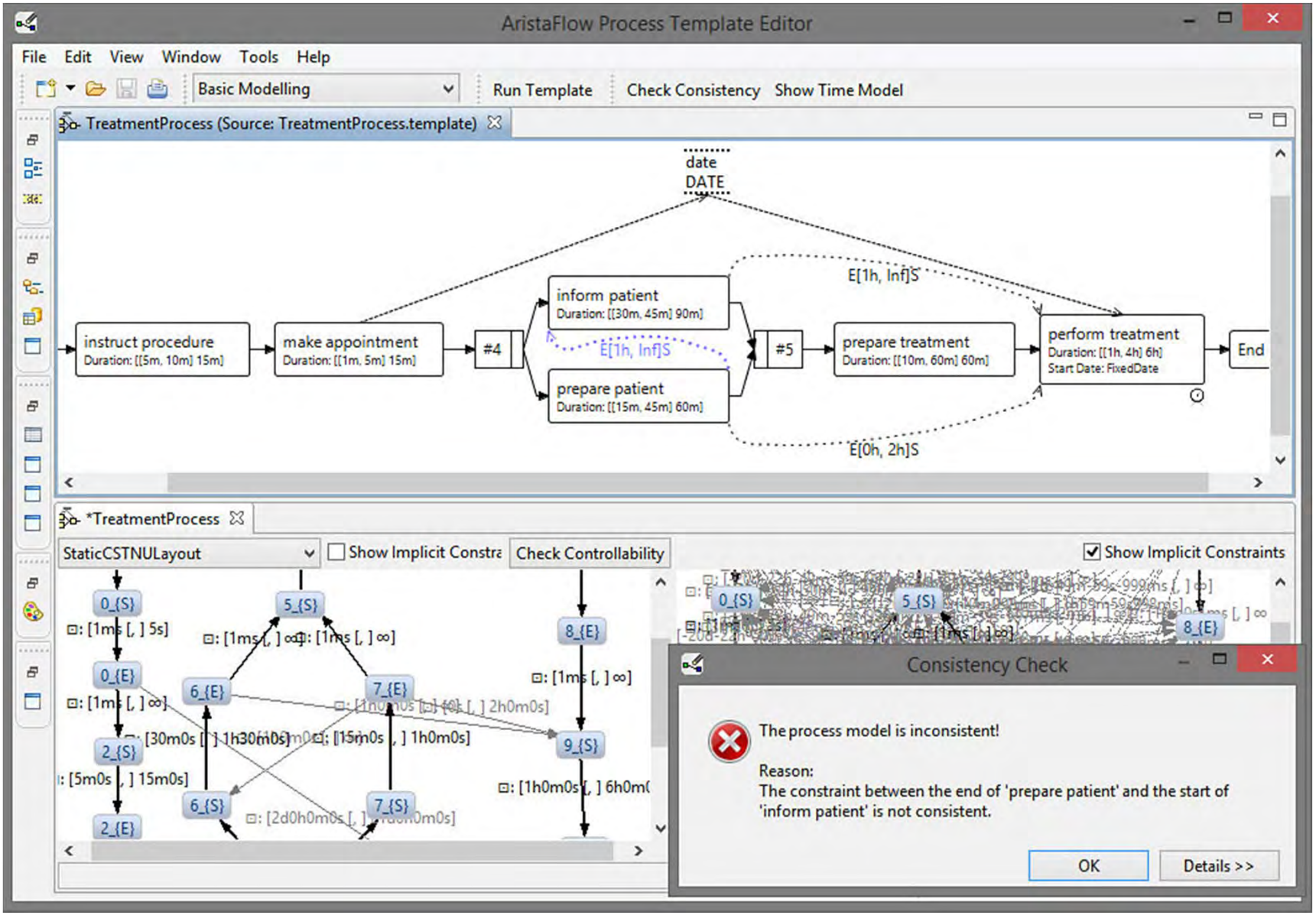
Business Process Modeling:
Beyond the Control-Flow Perspective



ATAPIS

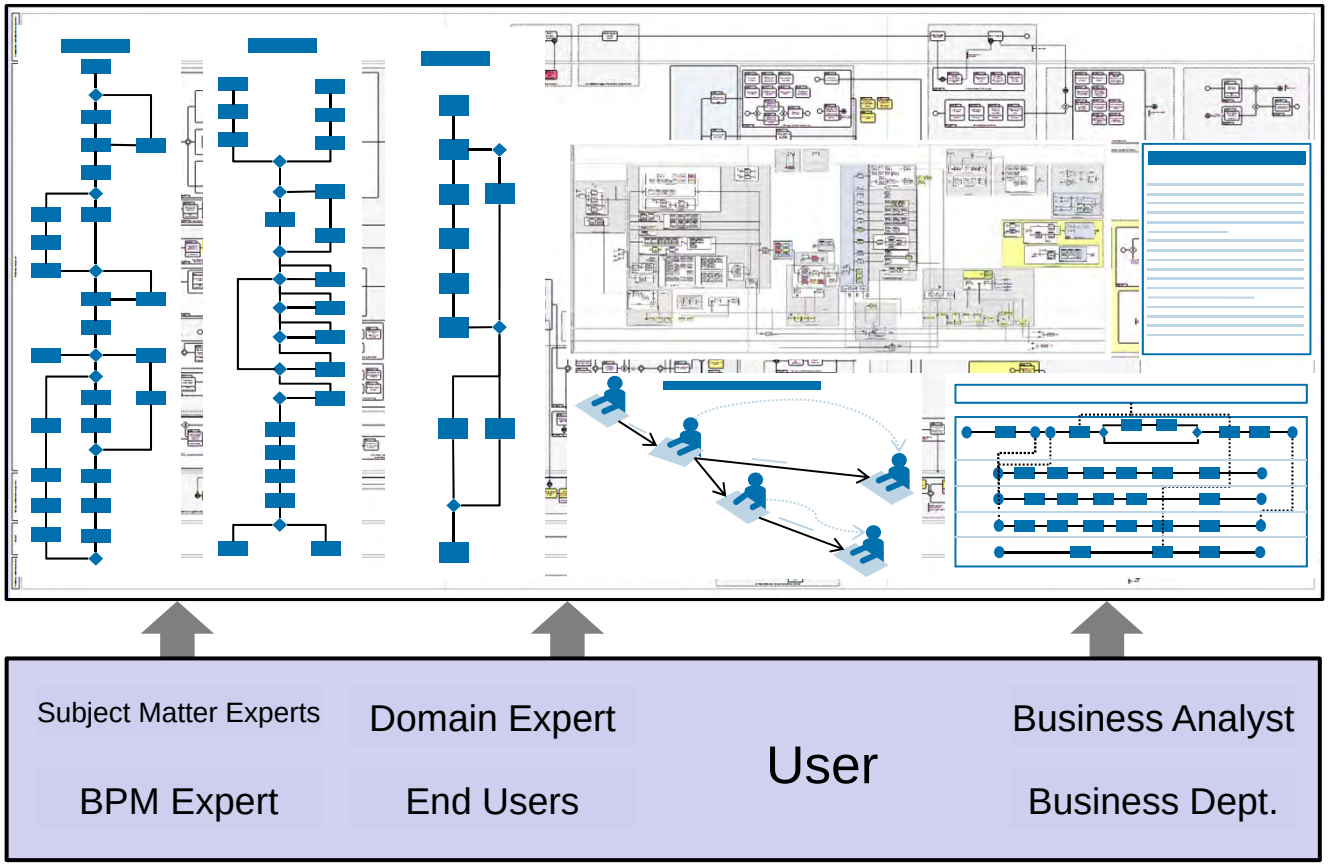
Lanz A., Weber B., Reichert, M. (2014): Time-Patterns for Process-Aware Information Systems. Requirements Engineering, 19(2): 113-141

Business Process Modeling: The ATAPIS Tool



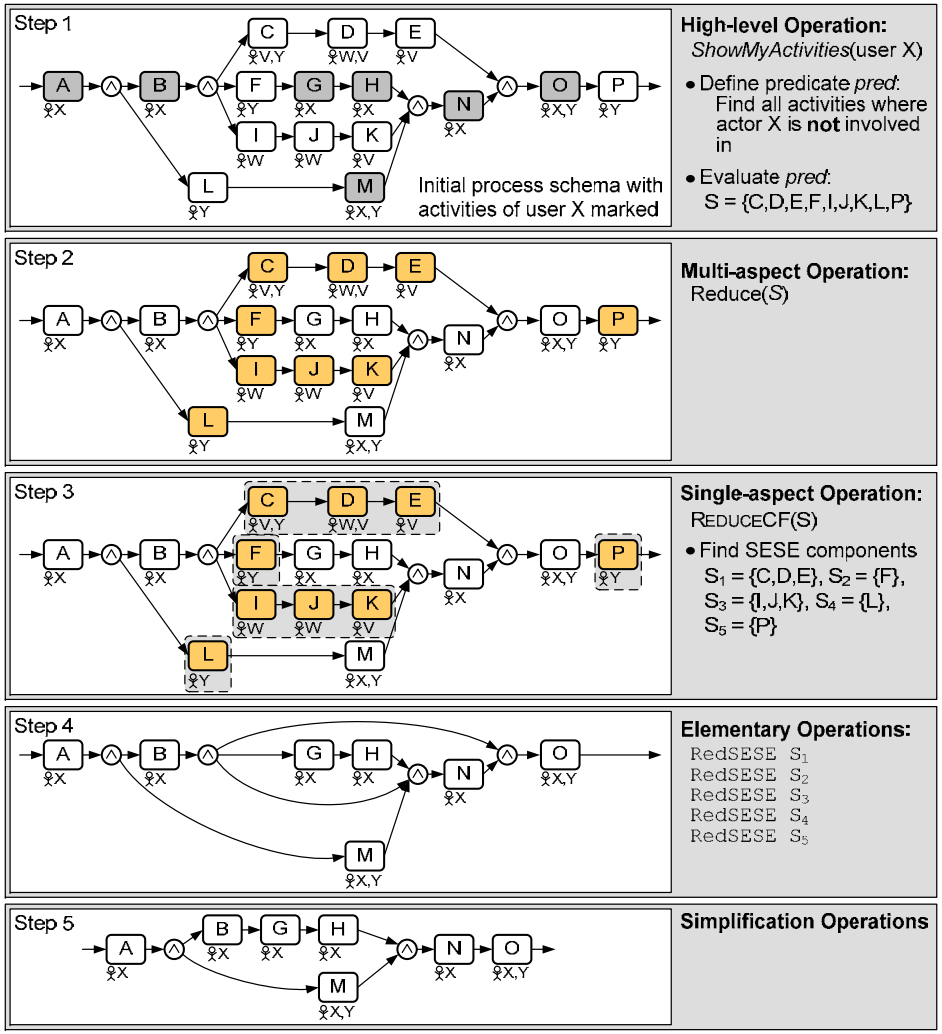
Lanz A., Posenato R., Combi C., Reichert, M. (2014): Controllability of Time-Aware Processes at Run-Time, Proc. CoopIS'14, pp. 39-56

Business Process Modeling:
Emergence of Process Repositories

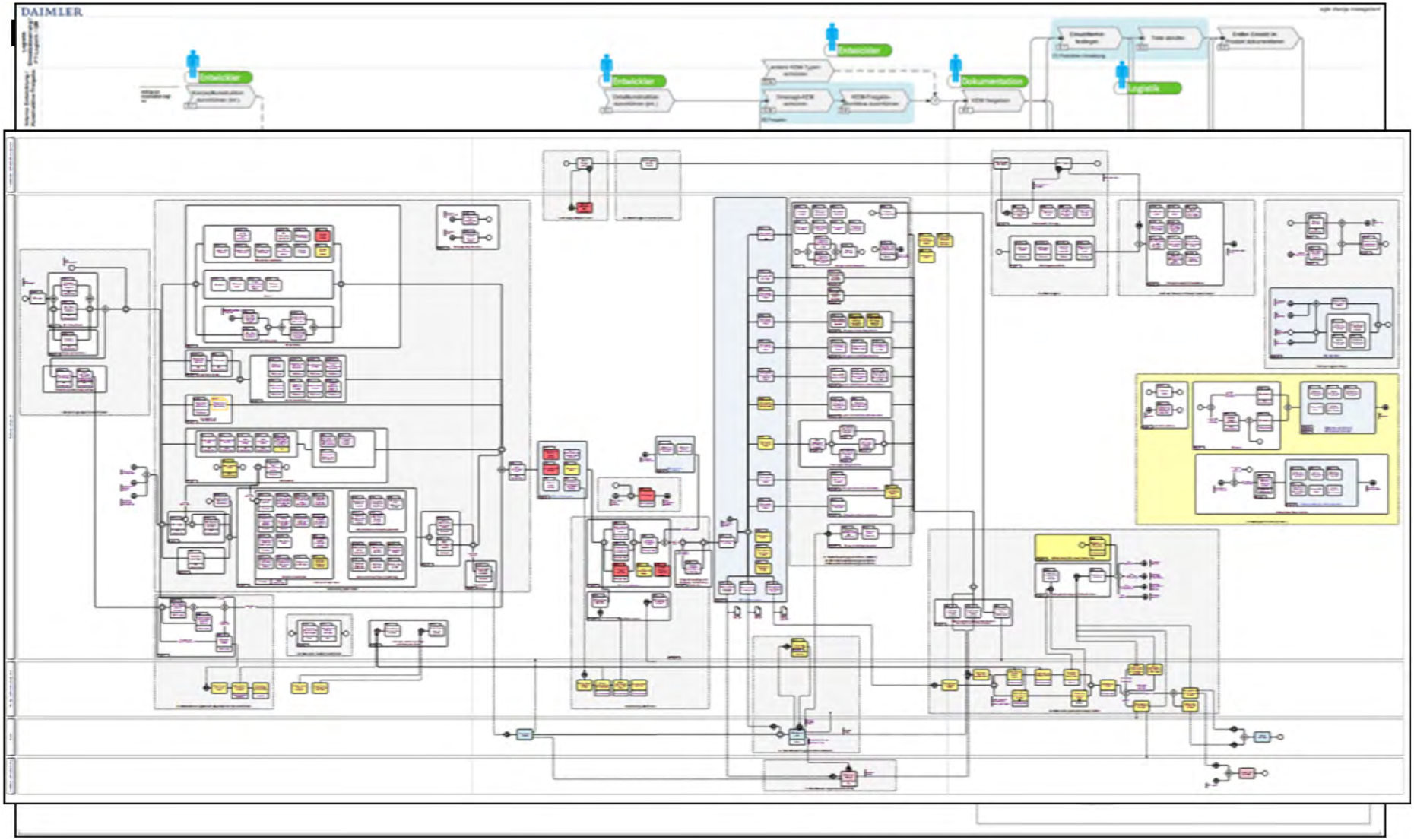


☞ **What kind of respository services are needed?**

Business Process Modeling:
Example: Process Model Abstraction



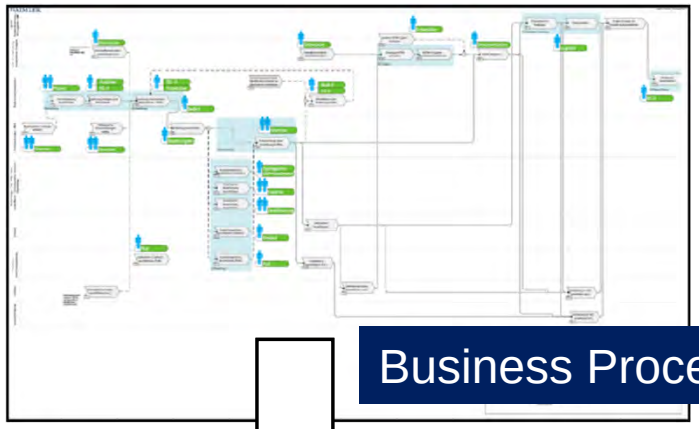
Process-Aware Business IT Alignment



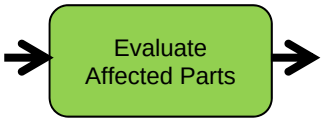
Process-Aware Business IT Alignment

Business IT Alignment Gap

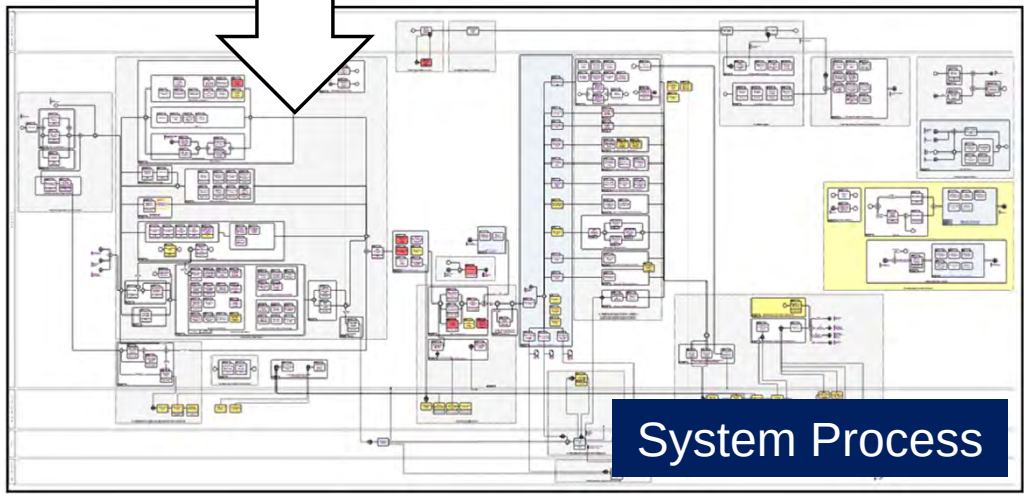
Business Level



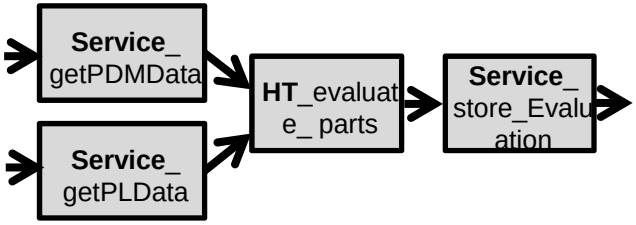
Business Process



IT Level

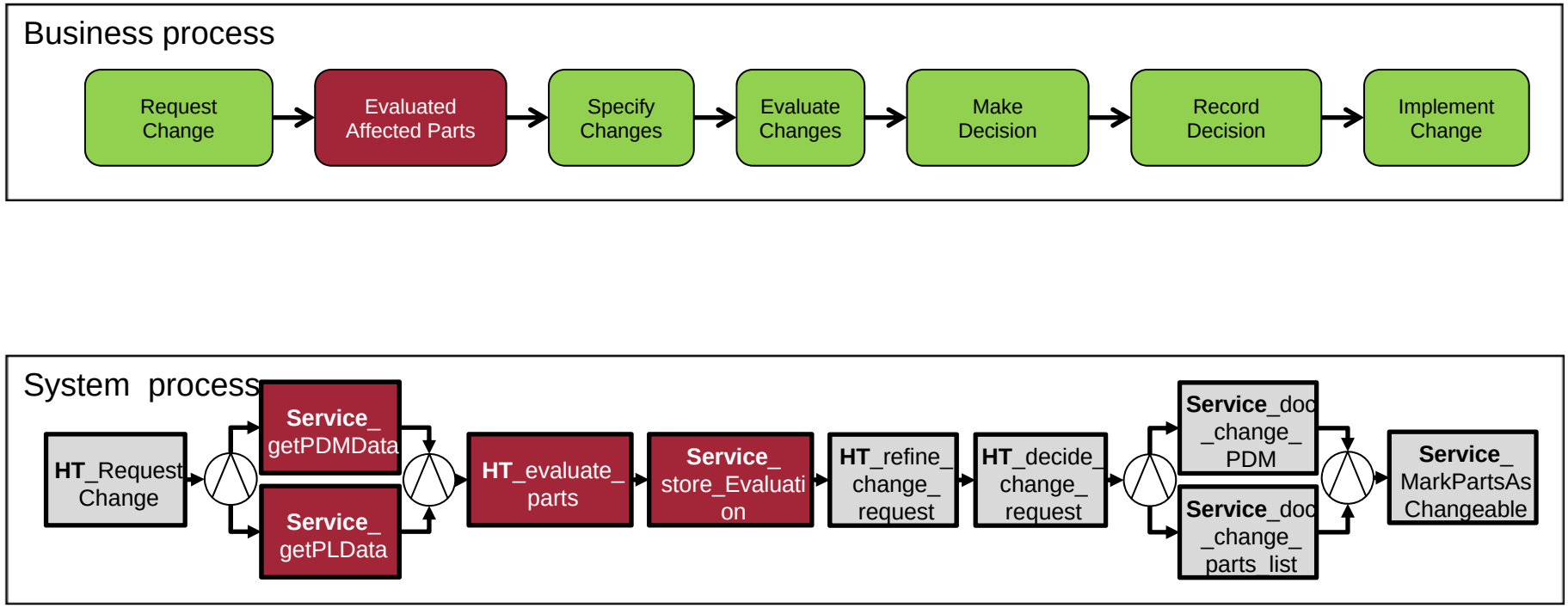


System Process



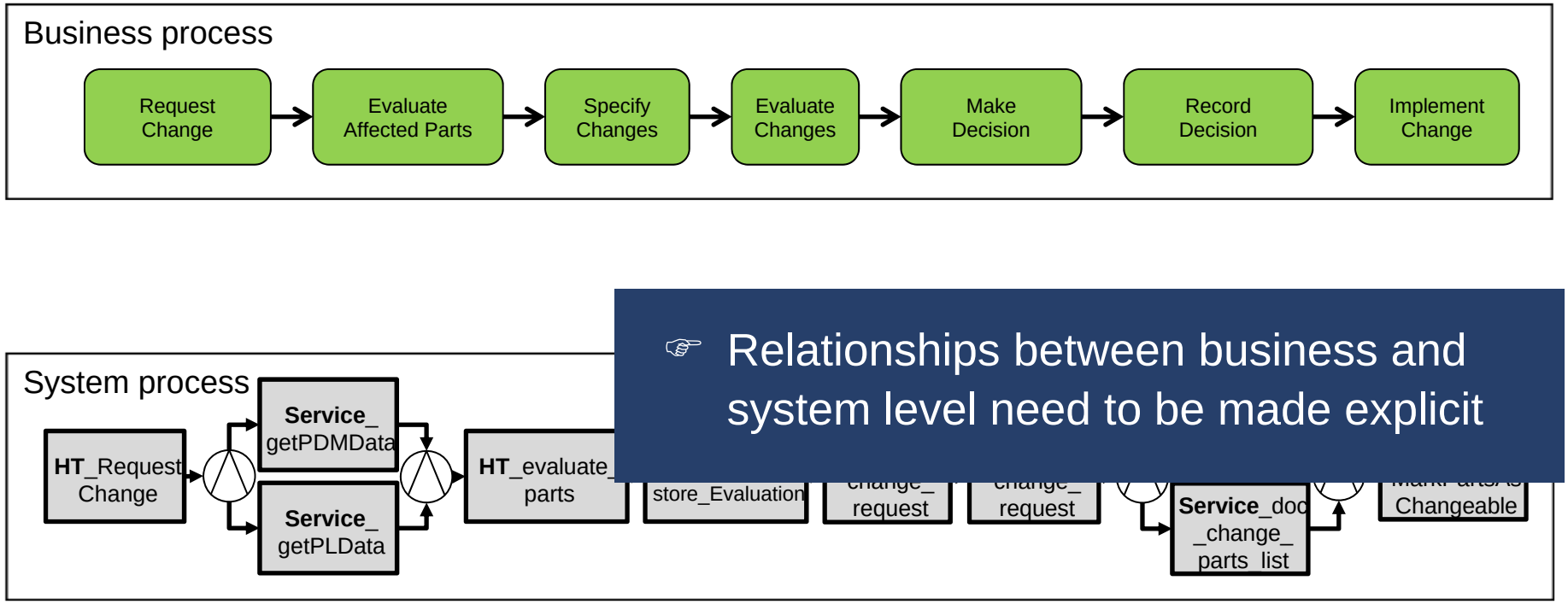
Process-Aware Business IT Alignment

Change Management Process in the Automotive Domain (simplified)



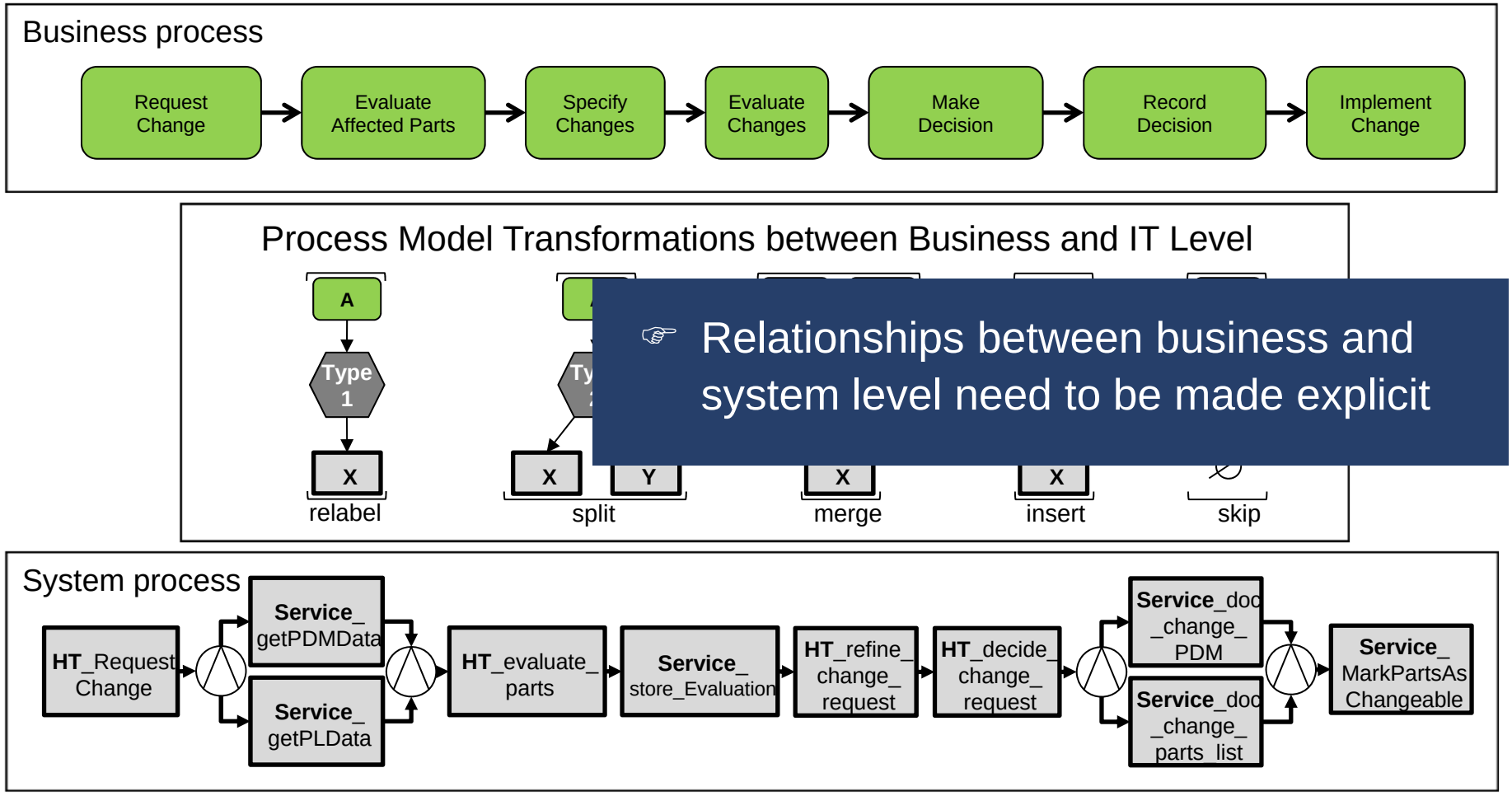
HT = Human Task

Process-Aware Business IT Alignment

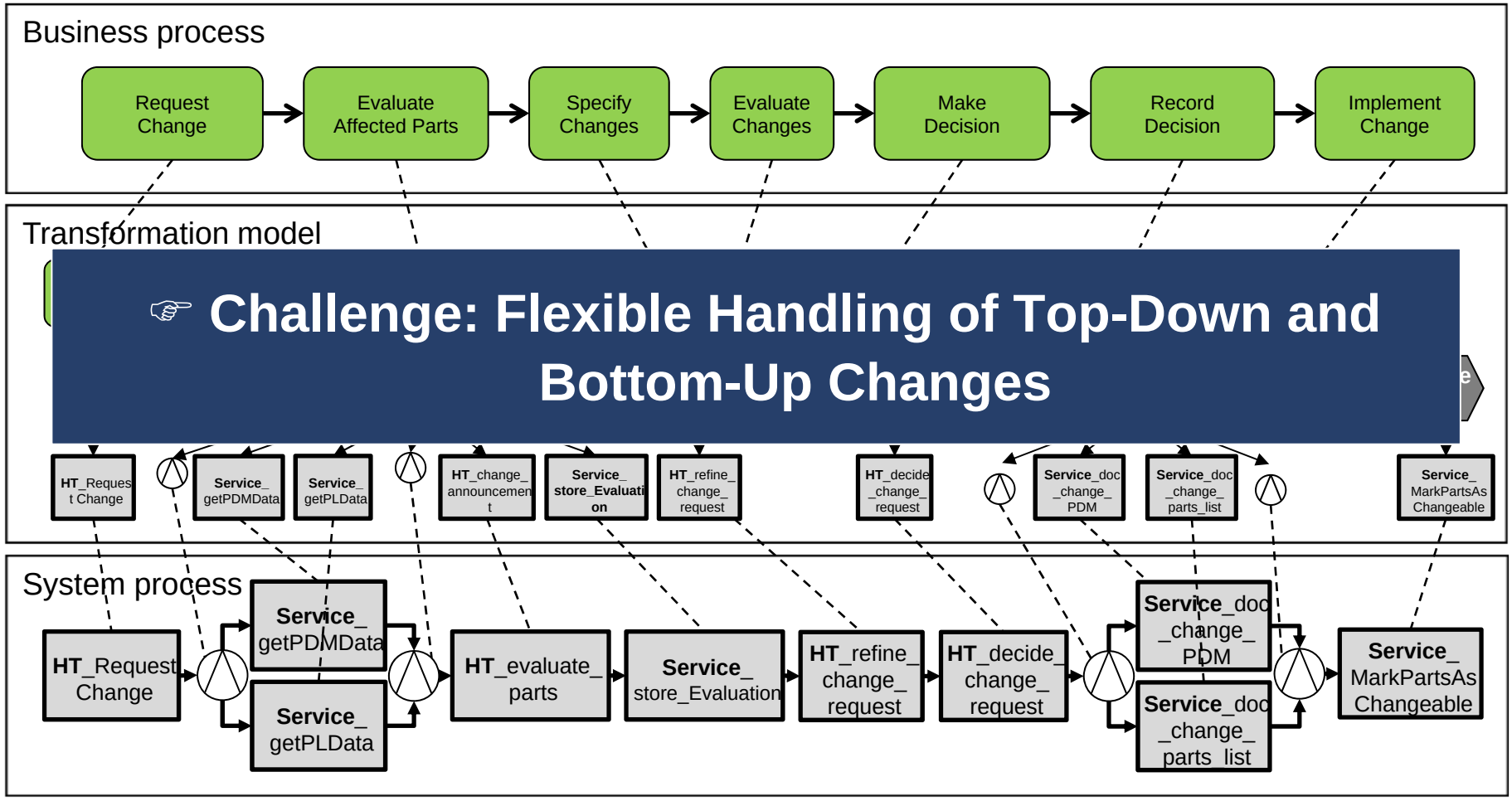


HT = Human Task

Process-Aware Business IT Alignment

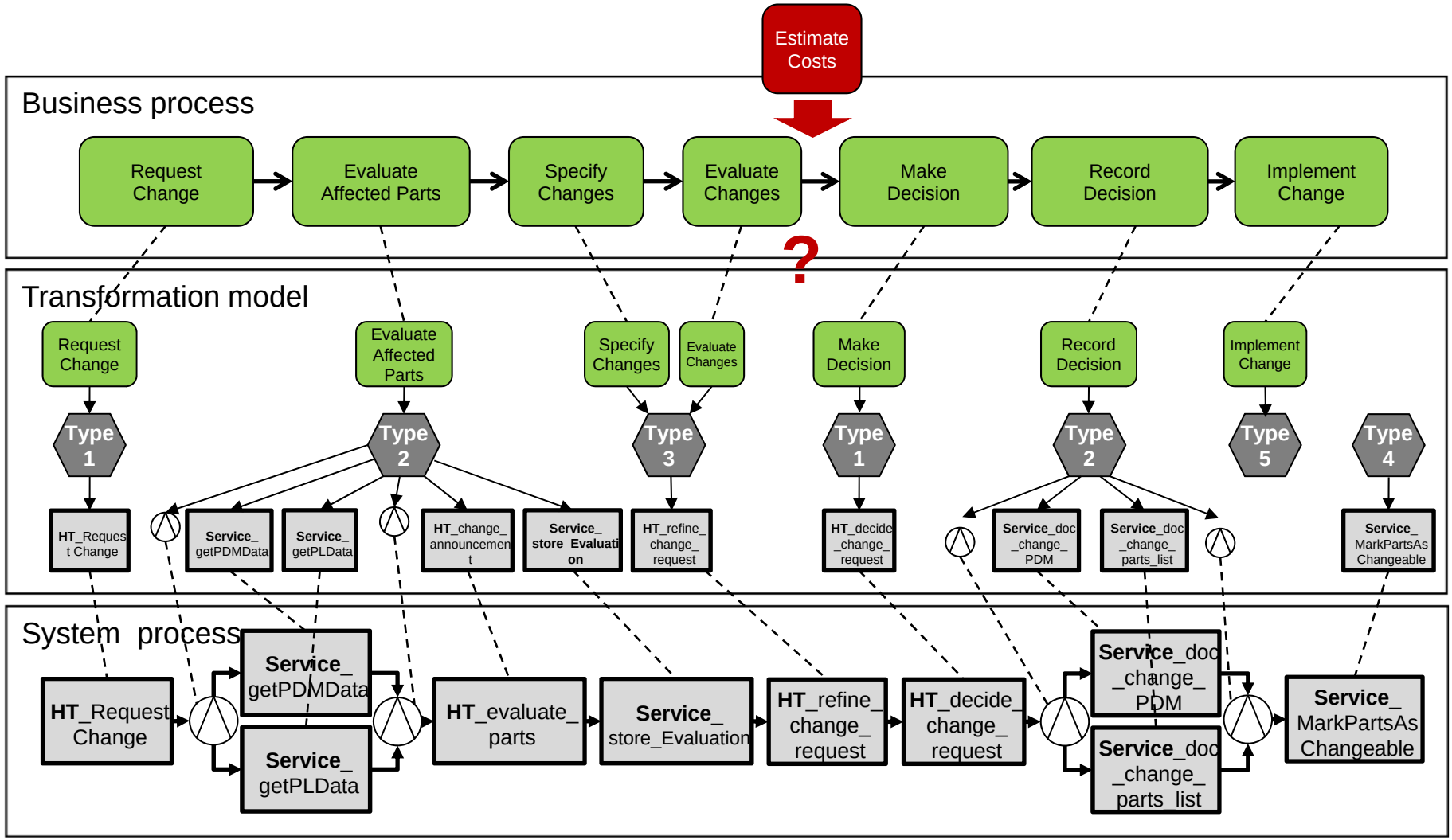


Process-Aware Business IT Alignment



HT = Human Task

Process-Aware Business IT Alignment



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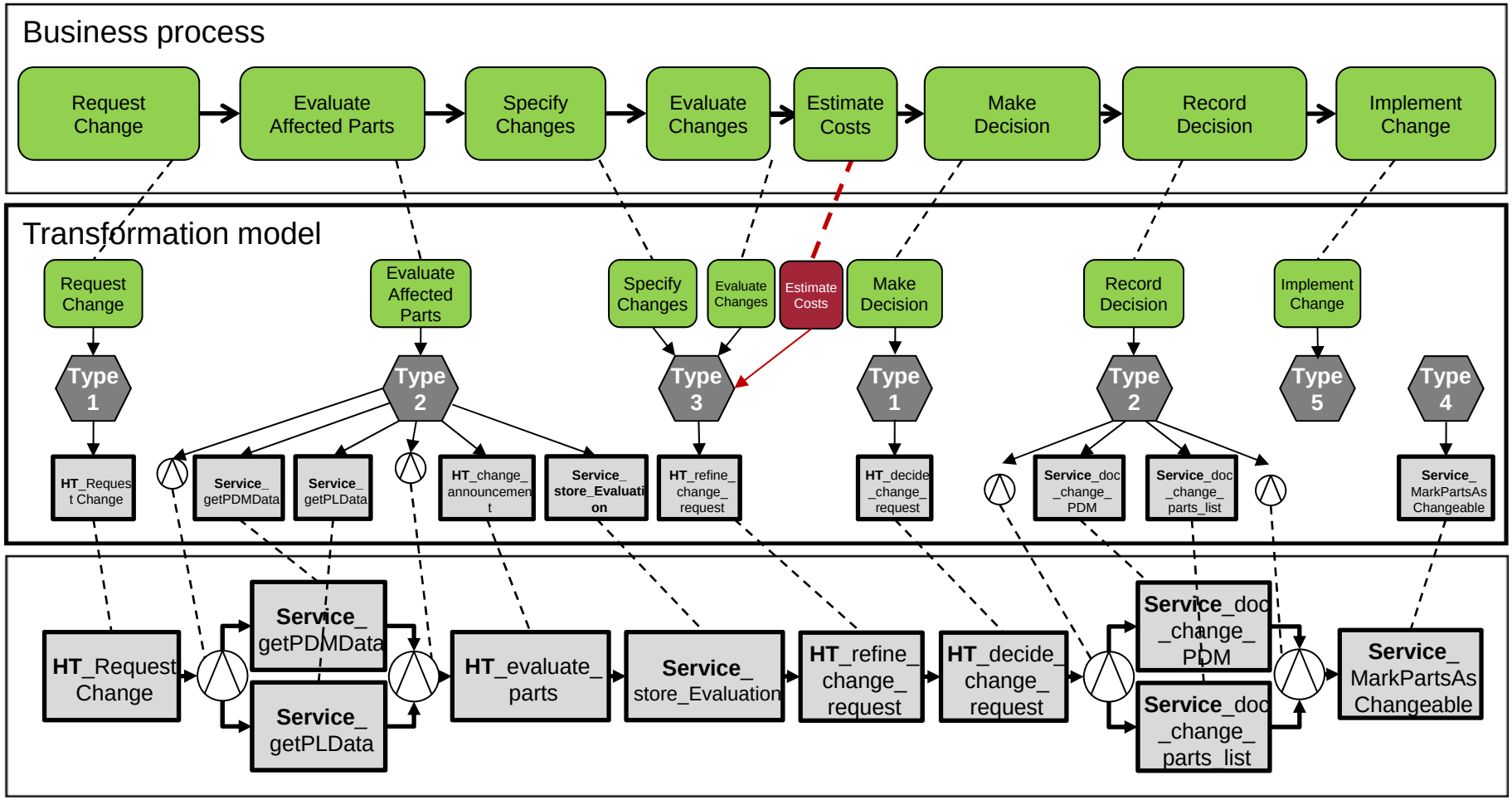
Process-Aware Business IT Alignment



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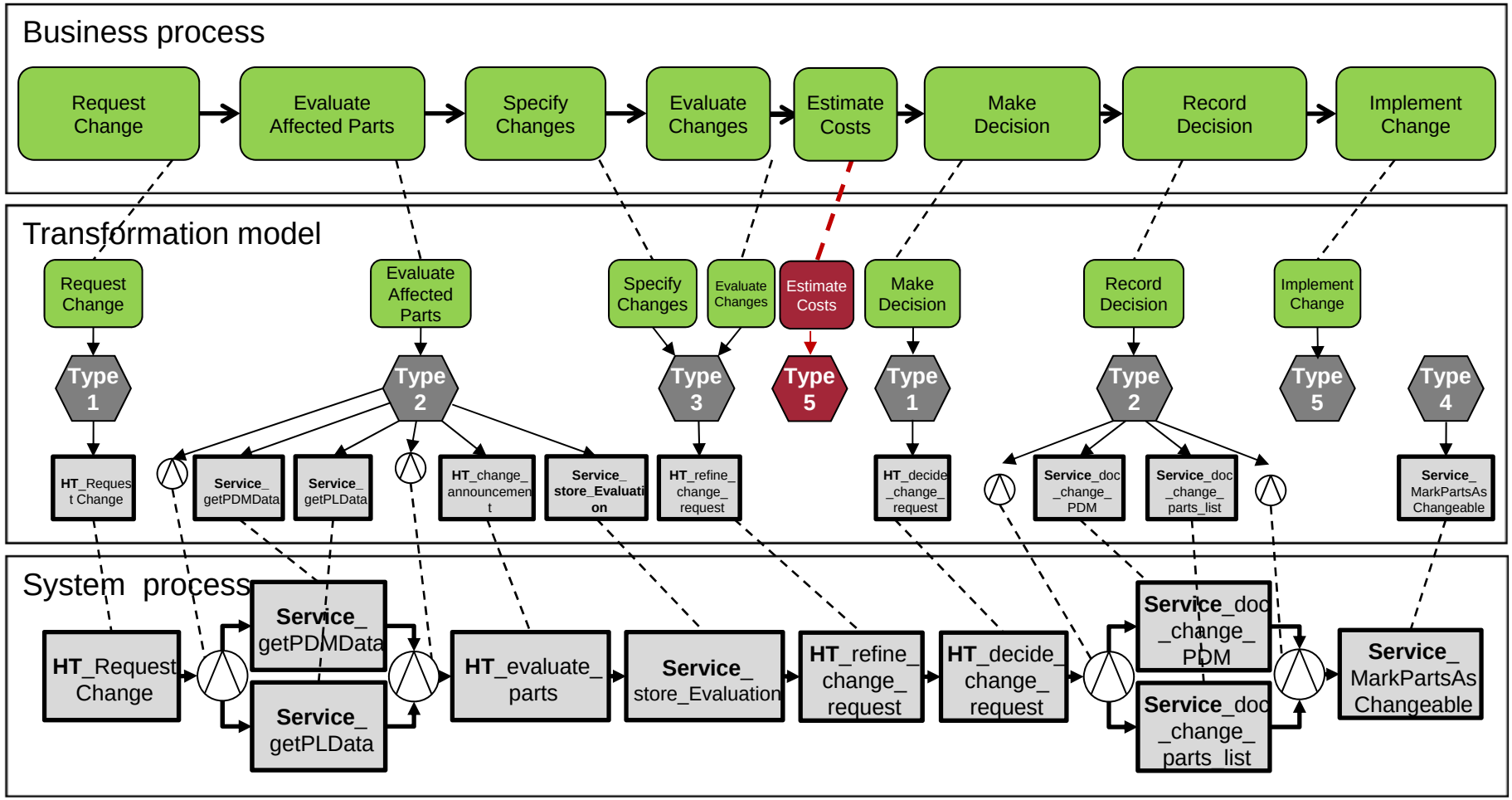
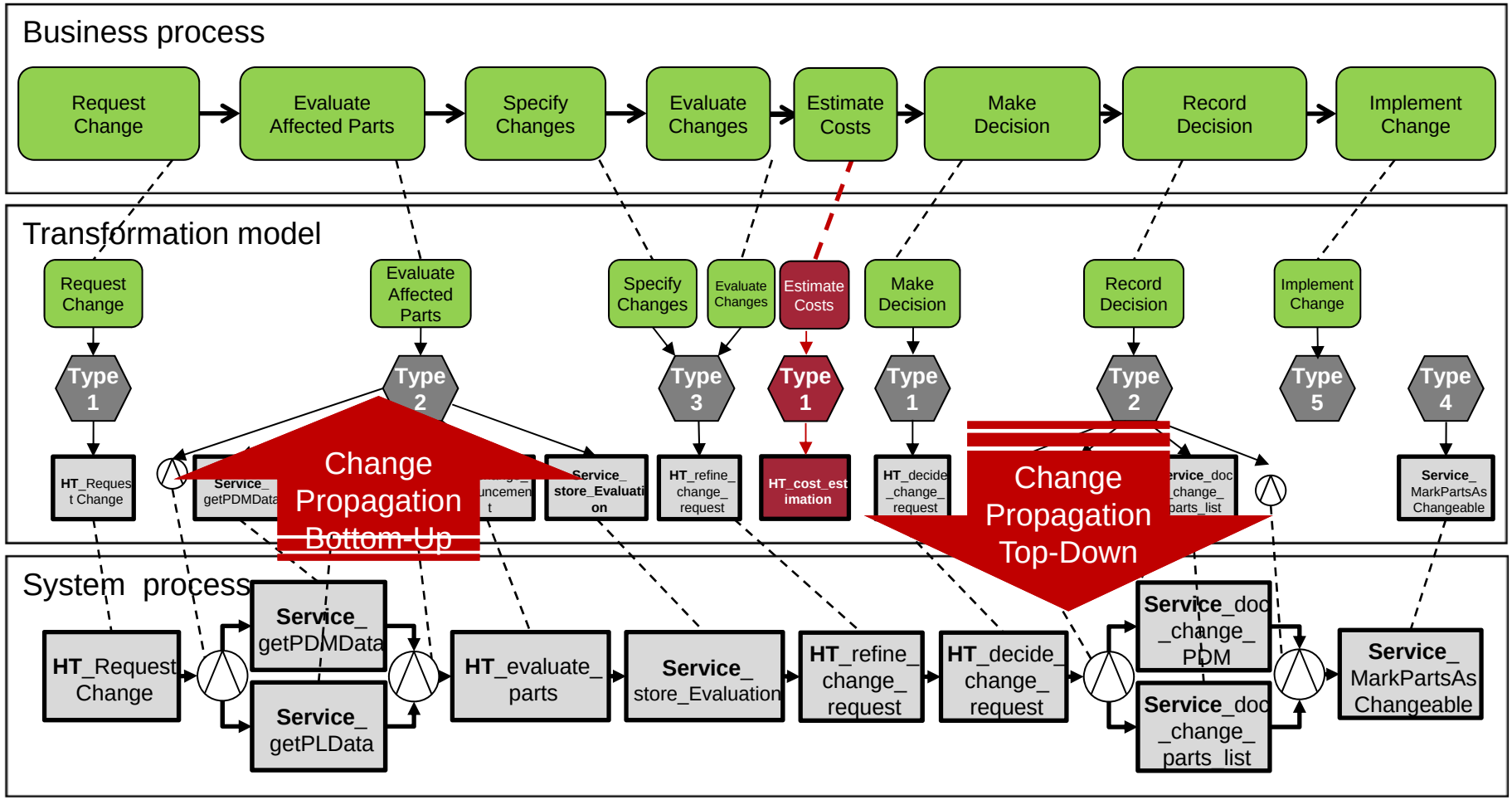
Process-Aware Business IT Alignment



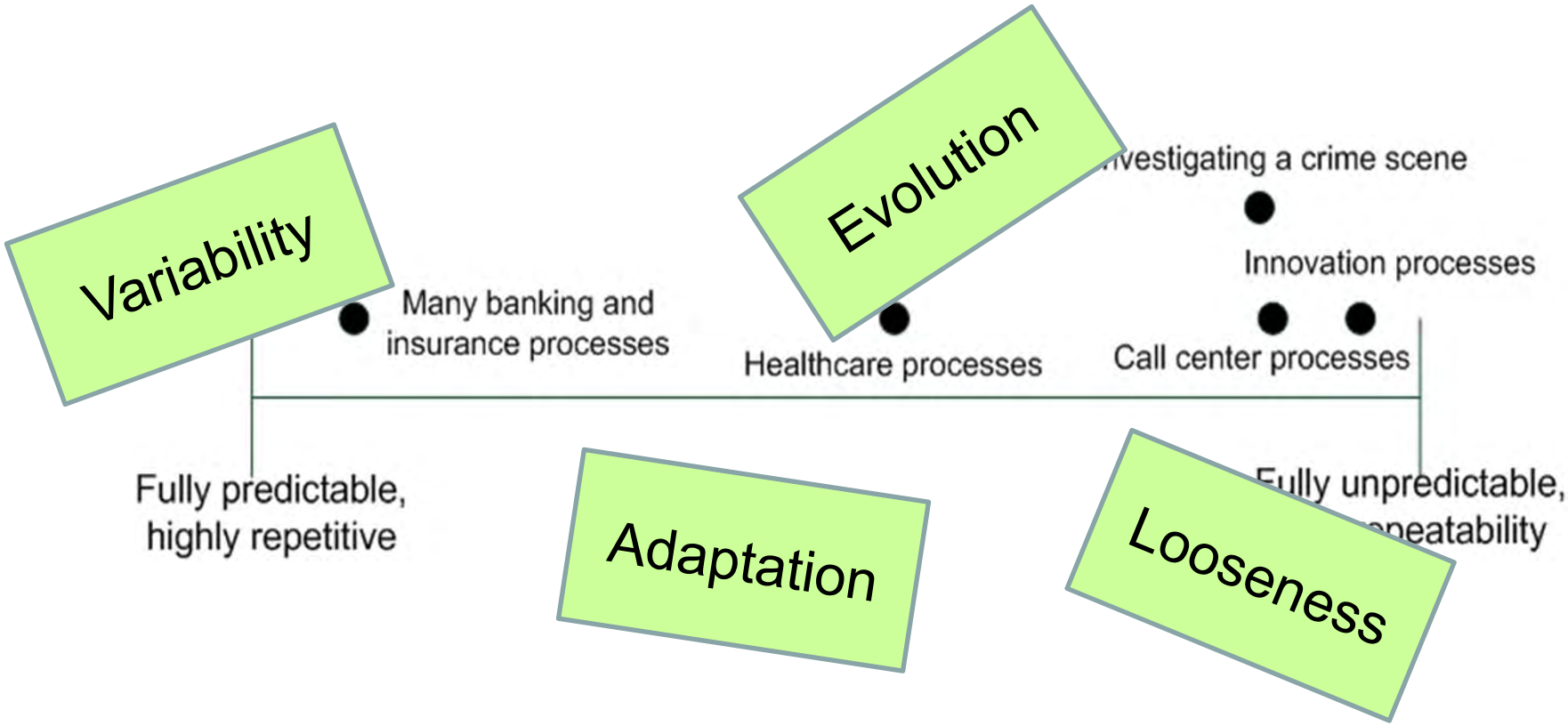
HT = Human Task

Process-Aware Business IT Alignment



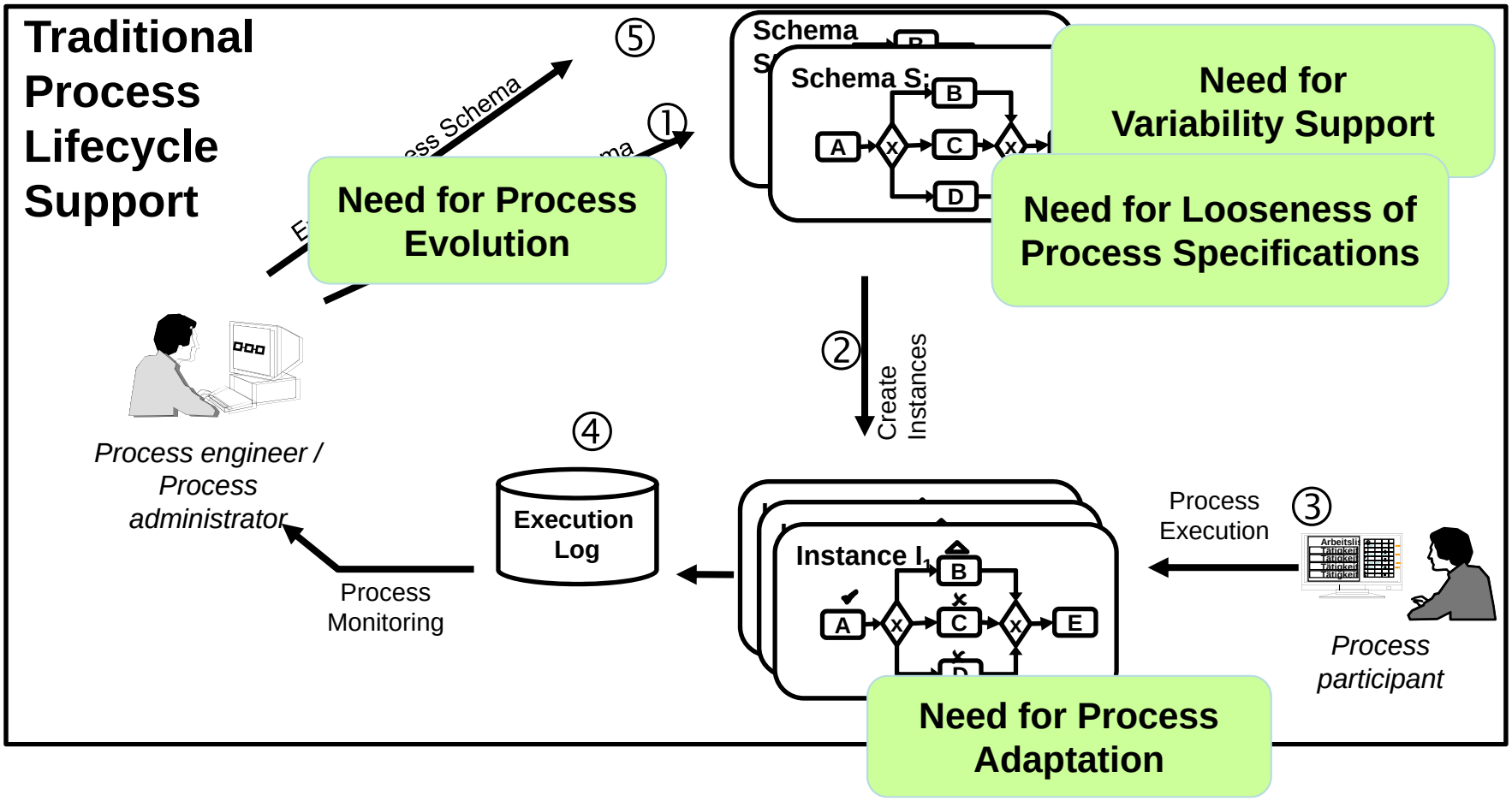
HT = Human Task

Process Flexibility



- Processes on the right side of the spectrum are mostly **knowledge-intensive**
- Knowledge-intensive processes are characerized by undpredictability, non-repeatability and emergence.

Flexibility Needs Along the Process Lifecylce



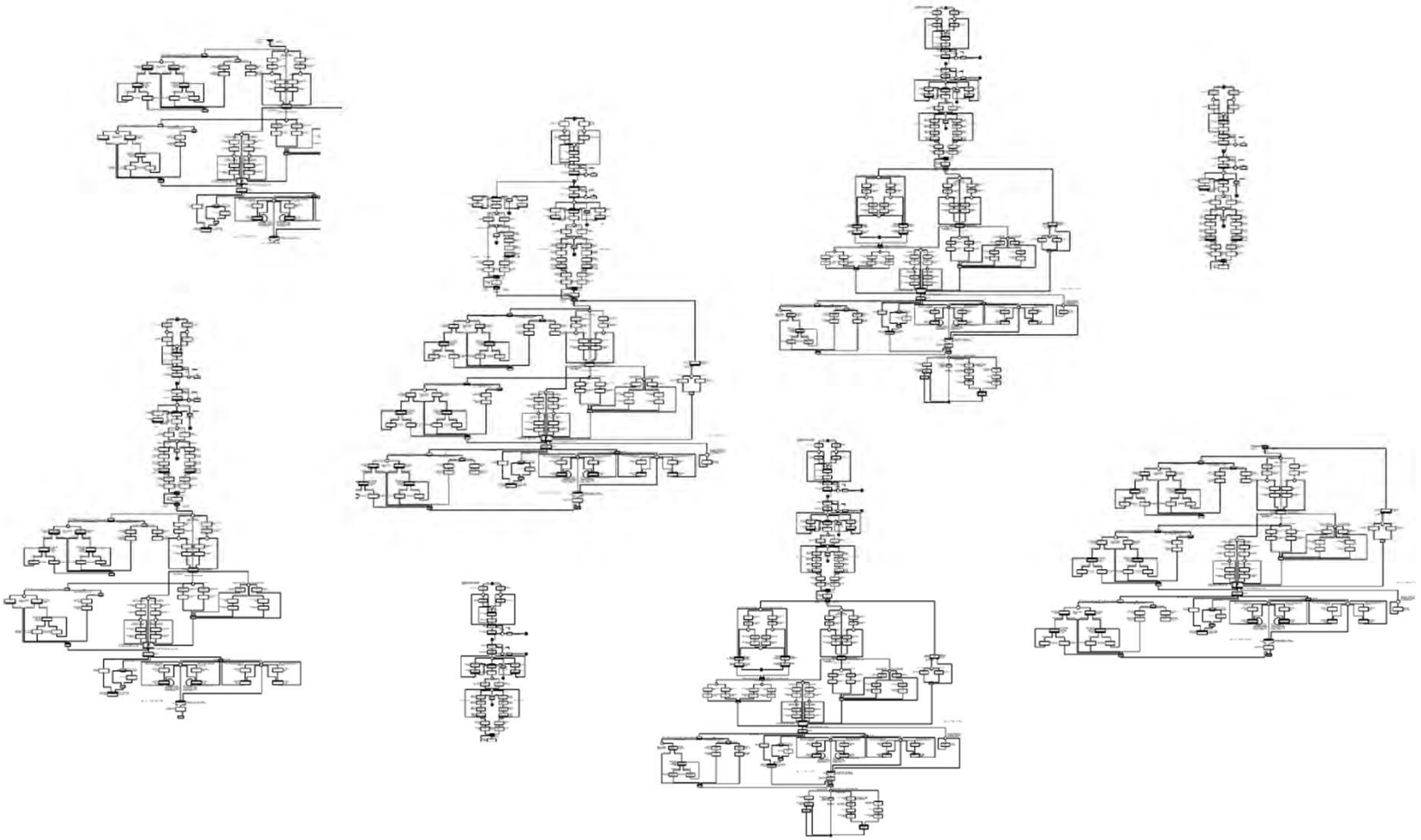
[Weber & Reichert, 2009]

Flexibility Need: Variability

- Variability is typical for many domains and requires that processes are handled differently depending on the given context
- Drivers
  - Product and service variability
  - Differences in regulations
  - Different customer groups
  - Temporal differences

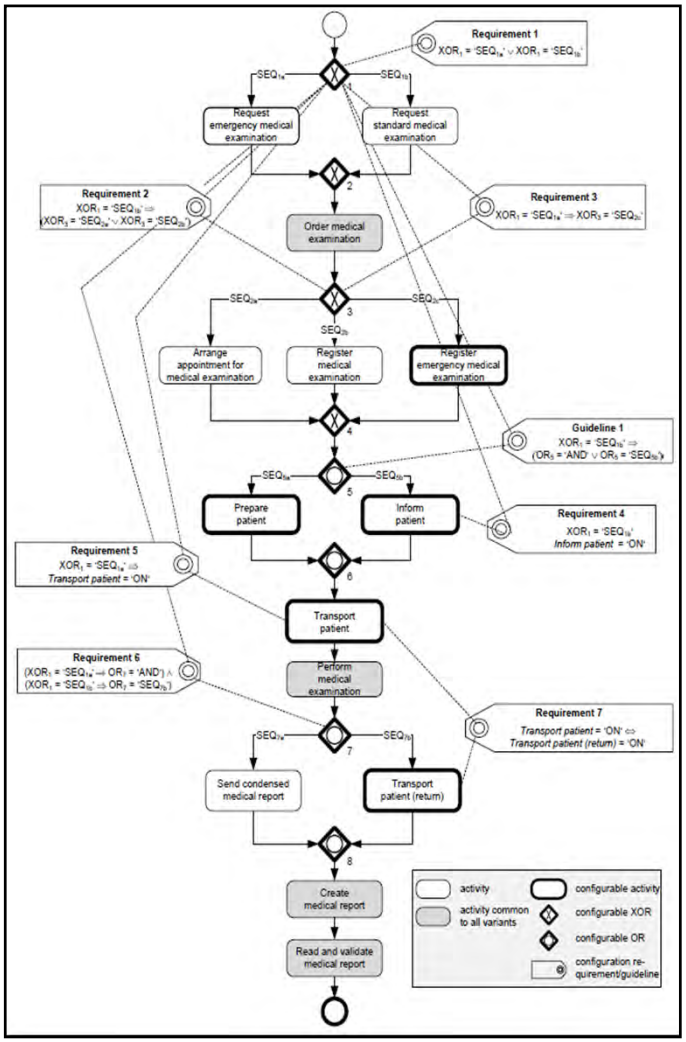
Example: Vehicle Repair

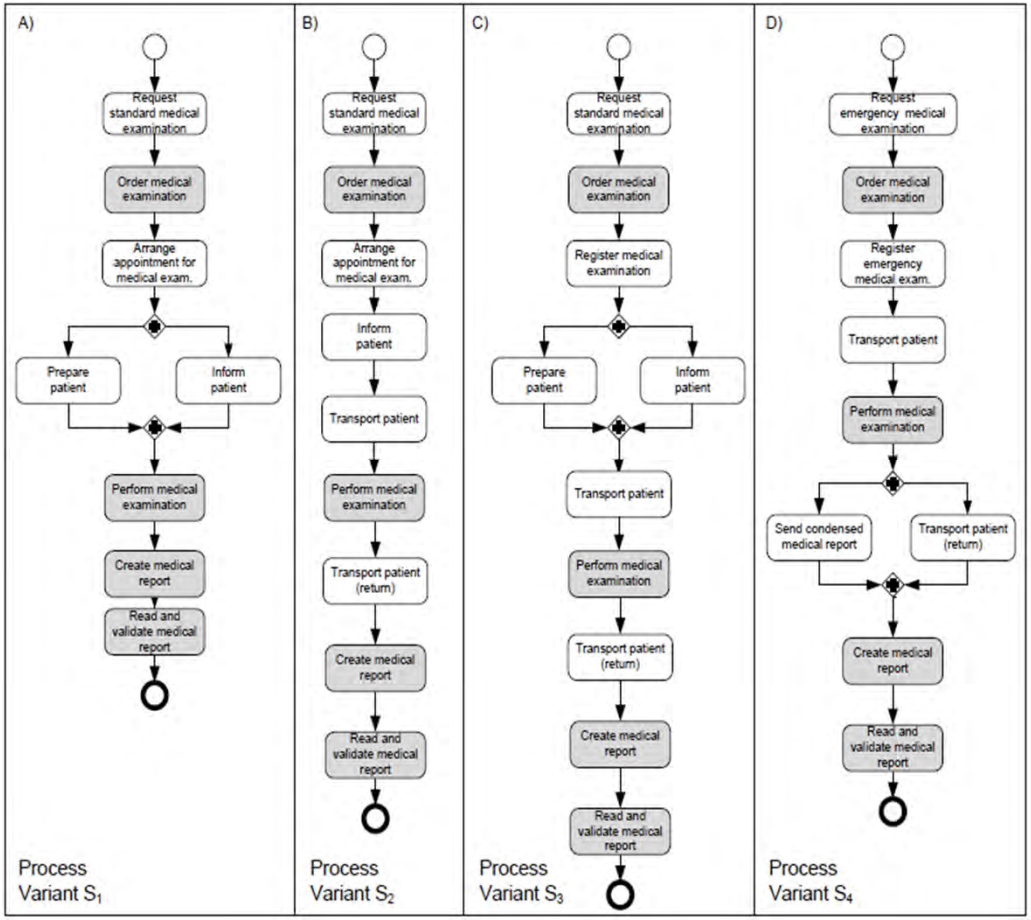
Process Variability Support:
The Problem



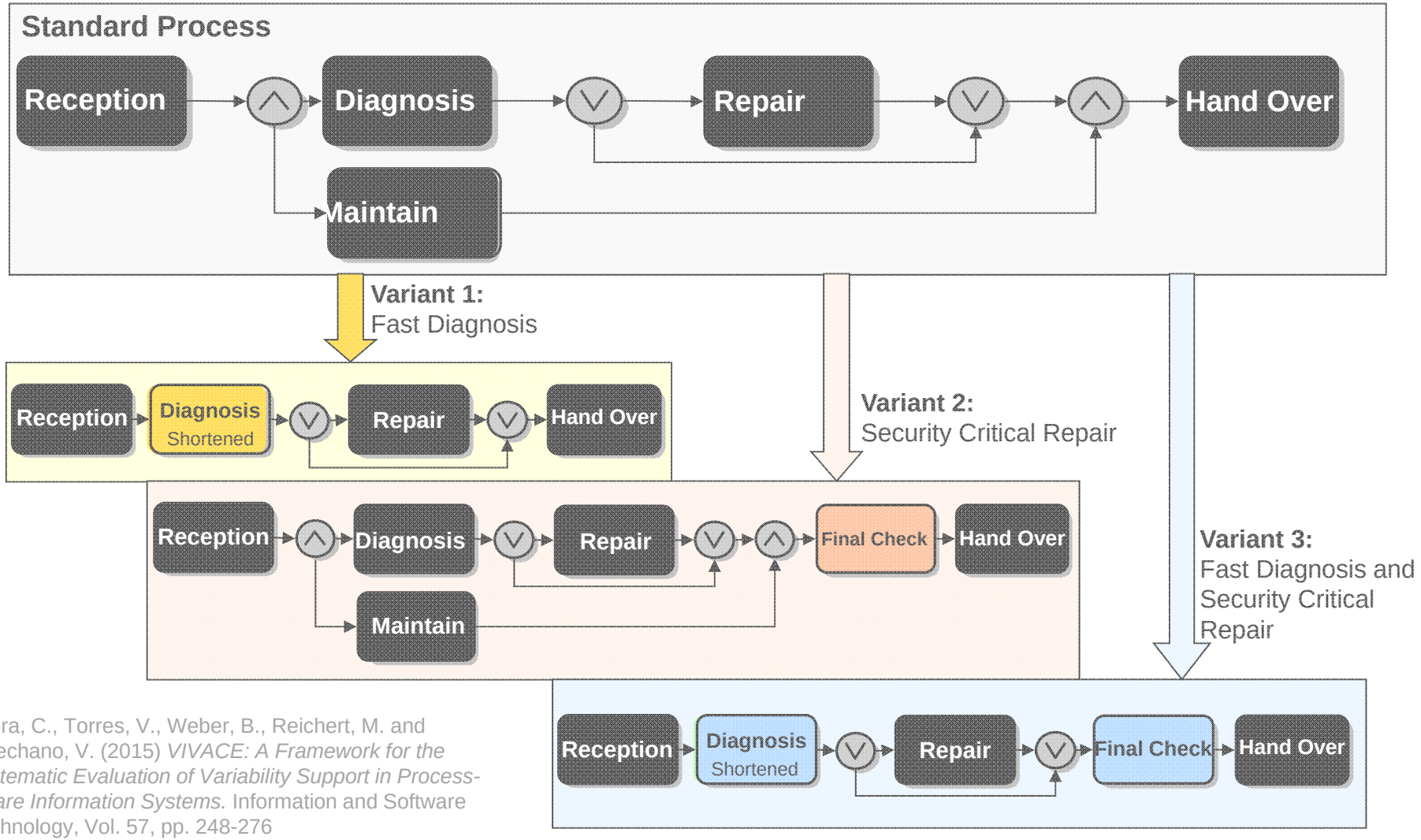
[La Rosa et al]

Process Variability Support:
Configurable Process Models



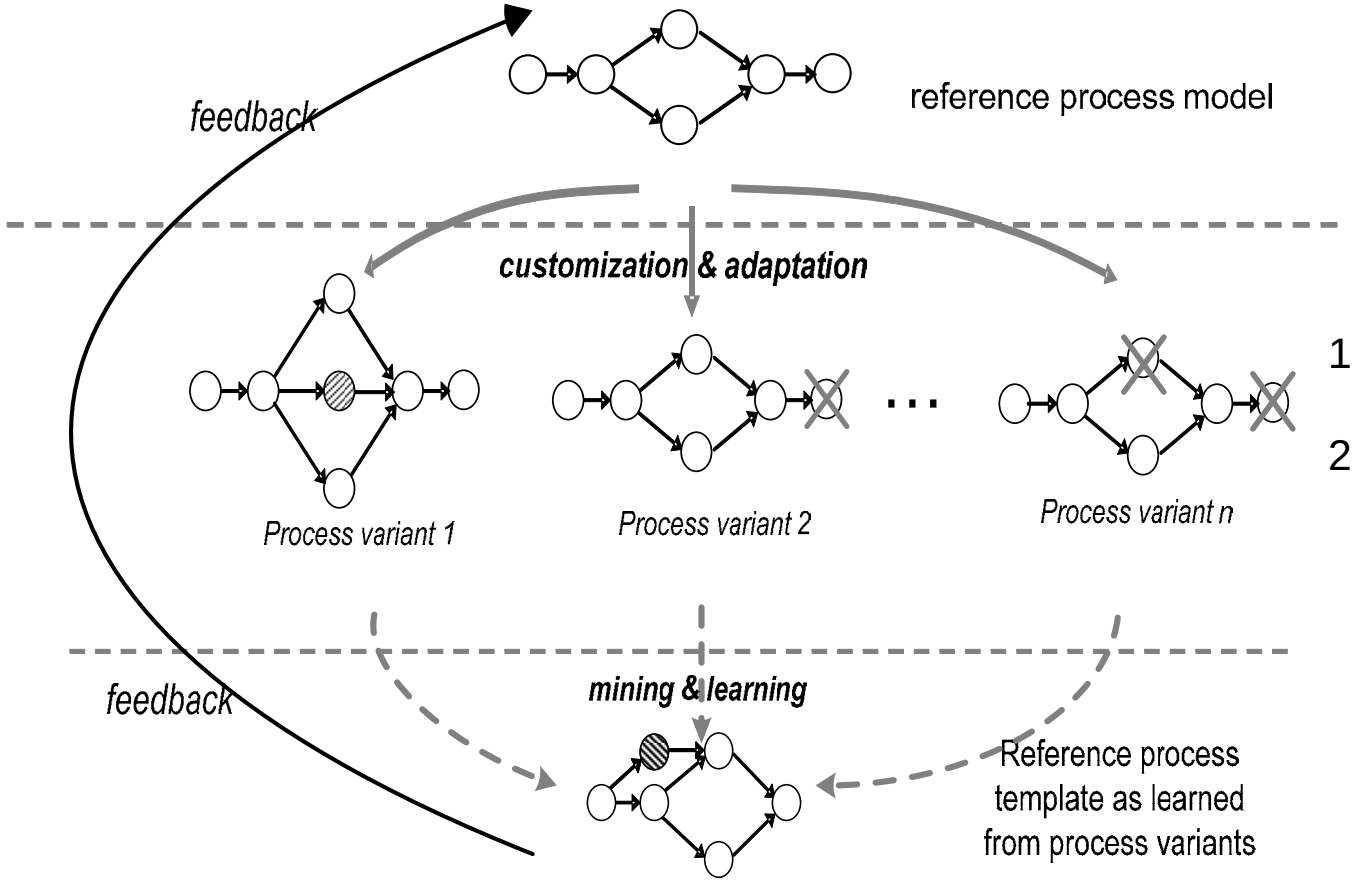


Process Variability Support:
Configuration through Pre-specified Adaptations



Ayora, C., Torres, V., Weber, B., Reichert, M. and Pelechano, V. (2015) *VIVACE: A Framework for the Systematic Evaluation of Variability Support in Process-Aware Information Systems.* Information and Software Technology, Vol. 57, pp. 248-276

Process Variability Support:
Learning From Applied Configurations



1. Changes are rather costly
2. Variants are difficult to maintain

Derive a new reference process model from the the variants such that:
Less adaptations are needed in future!

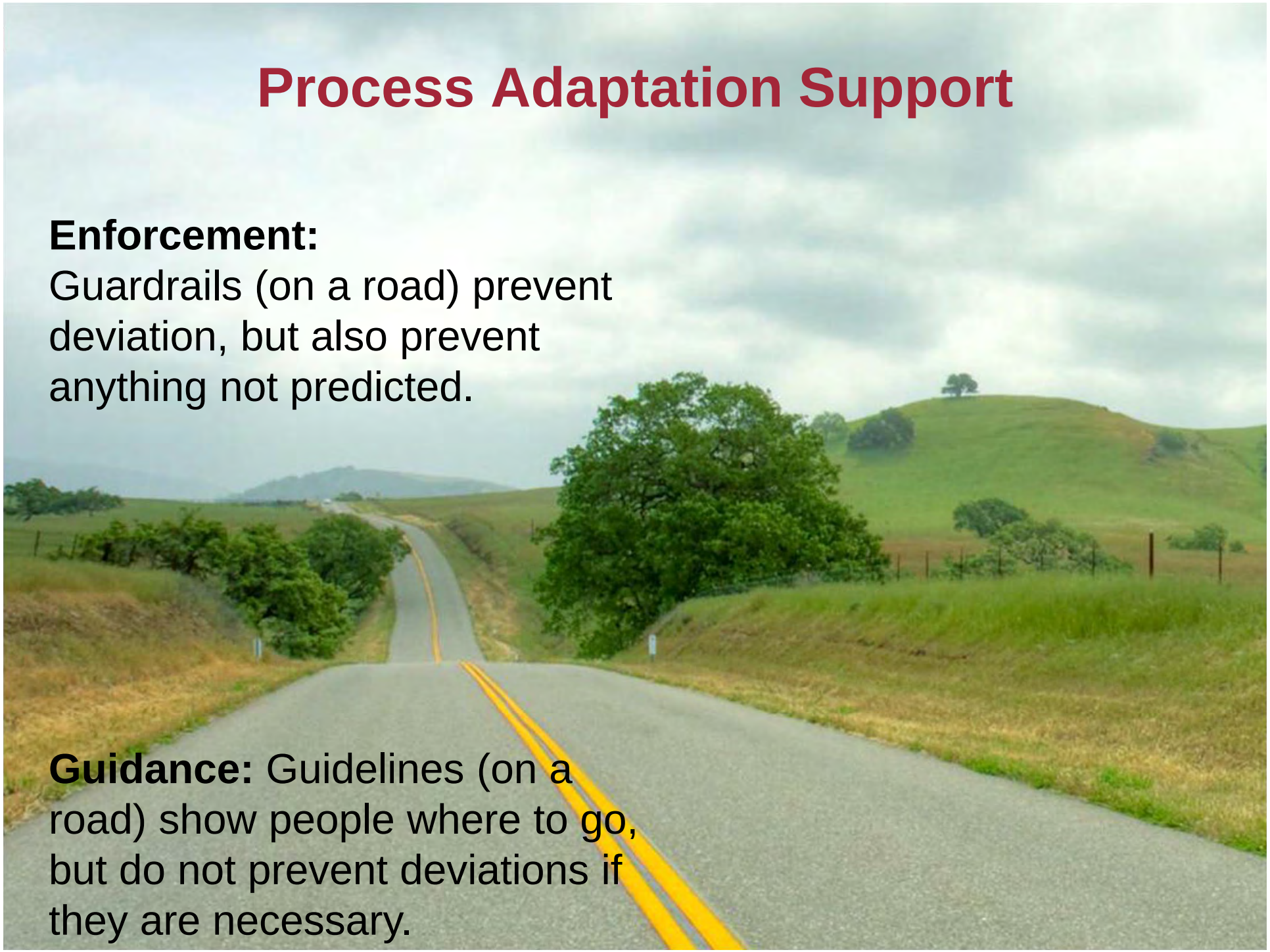
Li, C., Reichert, M., Wombacher, A. (2011) *Mining Business Process Variants: Challenges, Scenarios, Algorithms.* Data & Knowledge Engineering, Vol. 70, No. 5, pp. 409-434,

Flexibility Need: Adaptation

- Ability to structurally adapt the schema of single cases (i.e. process instances) to a contextual change
- Drivers
  - Special situations
  - Exceptions
- Anticipation of Adaptation
  - Planned
  - Unanticipated

Example: Transportation Process

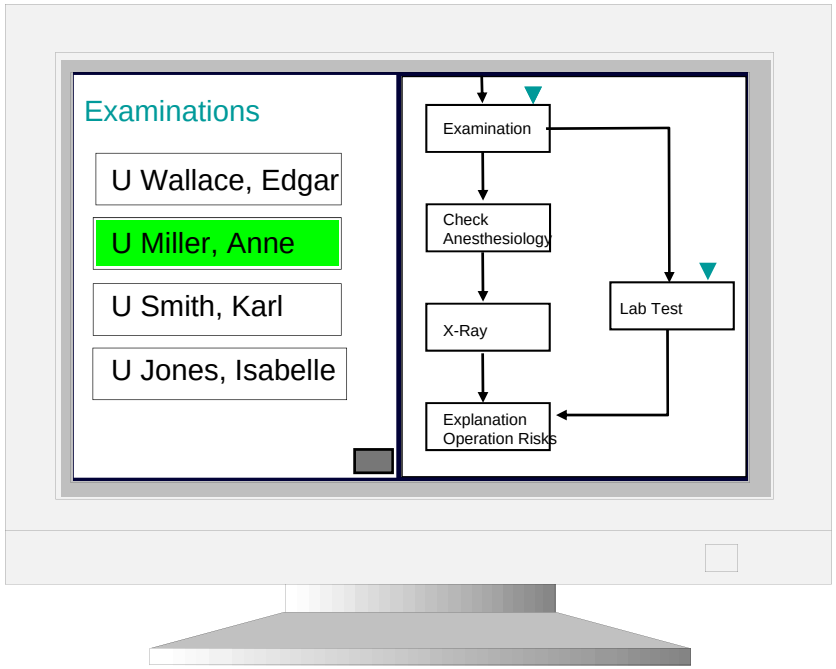
Process Adaptation Support



Enforcement:
Guardrails (on a road) prevent deviation, but also prevent anything not predicted.

Guidance: Guidelines (on a road) show people where to go, but do not prevent deviations if they are necessary.

Process Adaptation Support:
The User Perspective



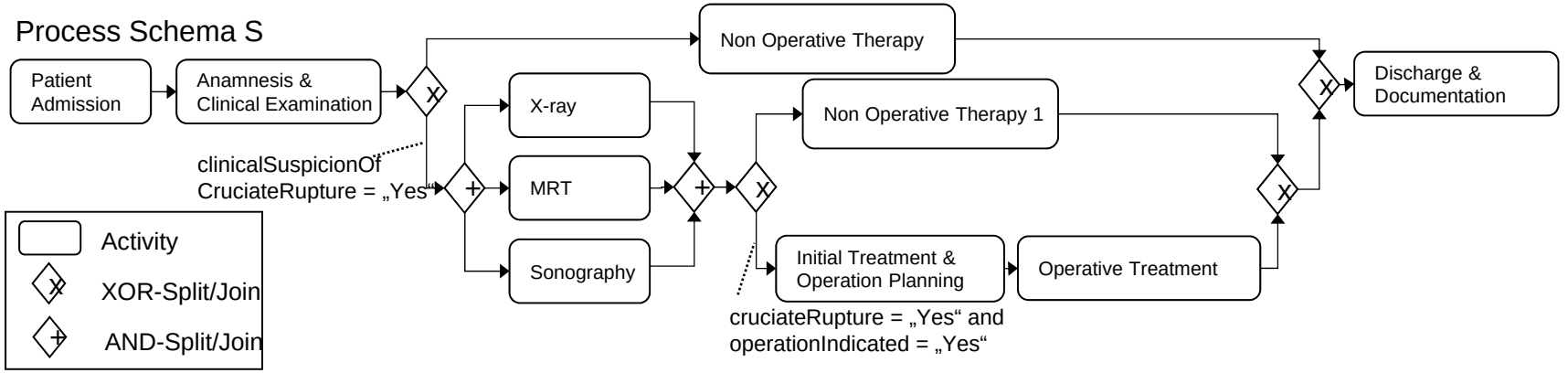
Reichert,M and Dadam, P (1998) *ADEPTflex-Supporting Dynamic Changes of Workflows Without Losing Control.* J of Intelligent Information Systems, 10(2): 93-129

Weber B, Reichert M, Rinderle-Ma, S (2008) *Change Patterns and Change Support Features - Enhancing Flexibility in Process-Aware Information Systems .* Data and Knowledge Engineering, 66(3): 438-466

Process Adaptation Support:
The System Perspective

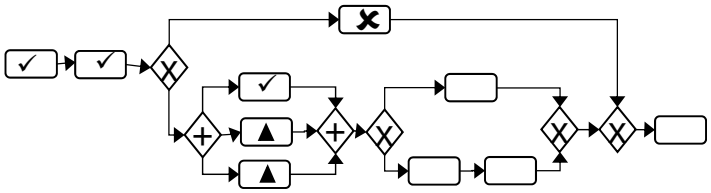
Process Type Level

Process Schema S



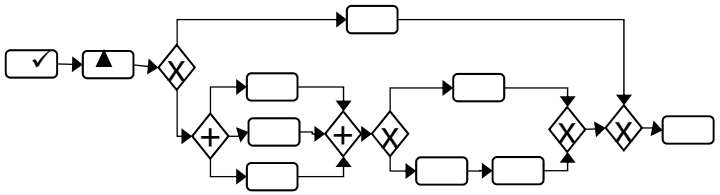
Process Instance Level

Process Instance I1



Execution Trace:
σ_1 = < „Patient Admission“, „Anamnesis & Clinical Examination“, „X-ray“>

Process Instance I2

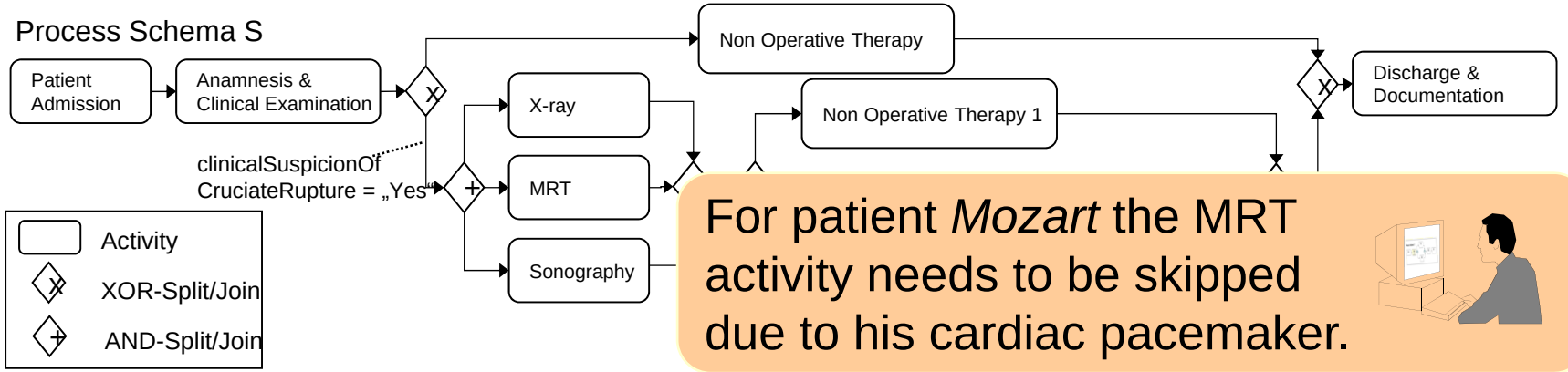


Execution Trace:
σ_2 = < „Patient Admission“>

Process Adaptation Support:
The System Perspective

Process Type Level

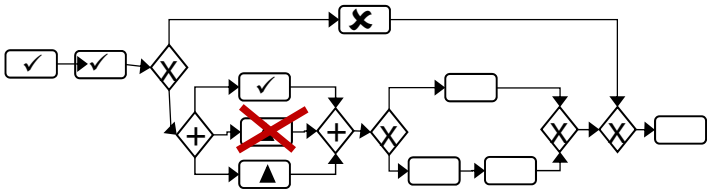
Process Schema S



For patient *Mozart* the MRT activity needs to be skipped due to his cardiac pacemaker.

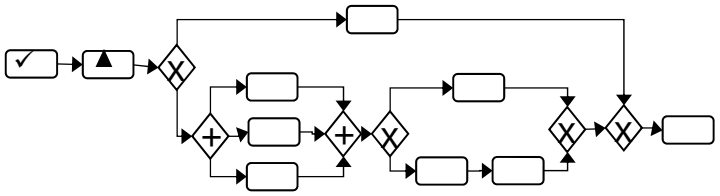
Process Instance Level

Process Instance I1



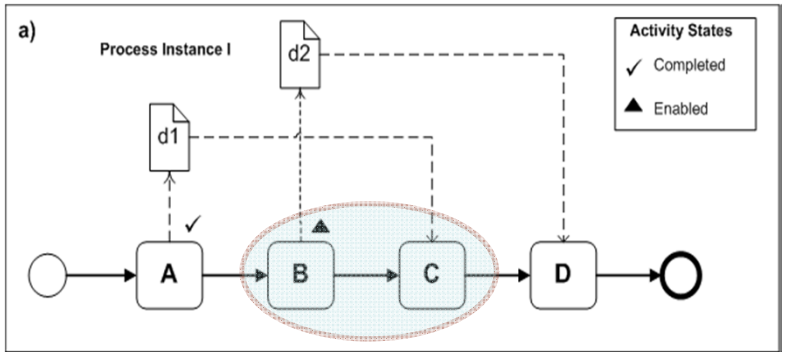
Execution Trace:
σ_1 = < „Patient Admission“, „Anamnesis & Clinical Examination“, „X-ray“>

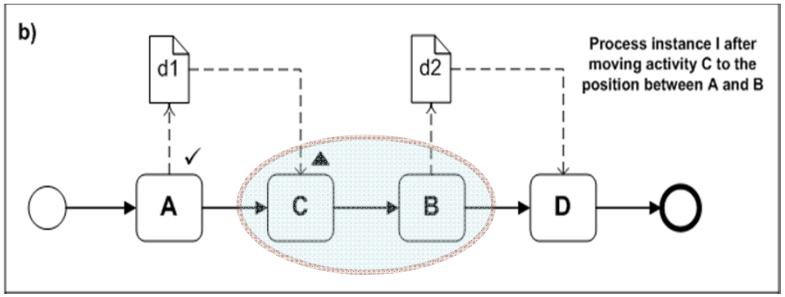
Process Instance I2

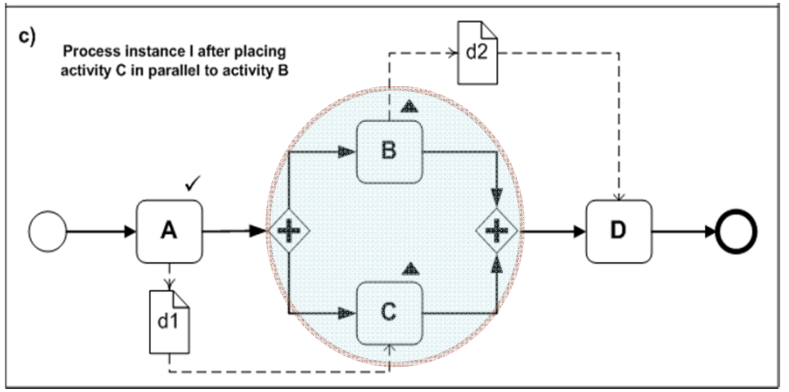


Execution Trace:
σ_2 = < „Patient Admission“>

Process Adaptation Support:
Dynamic Changes



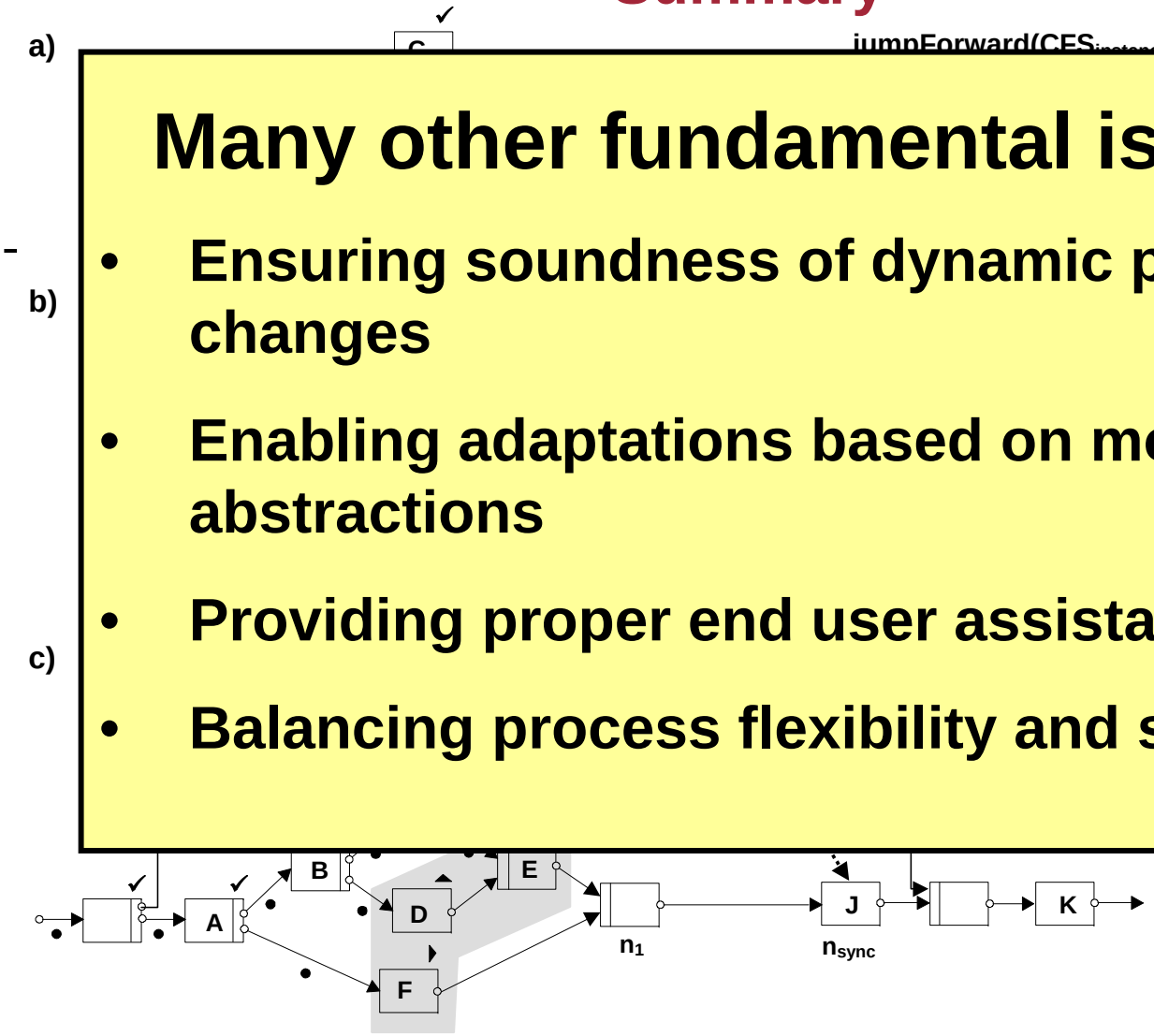




Process Adaptation Support:
Summary

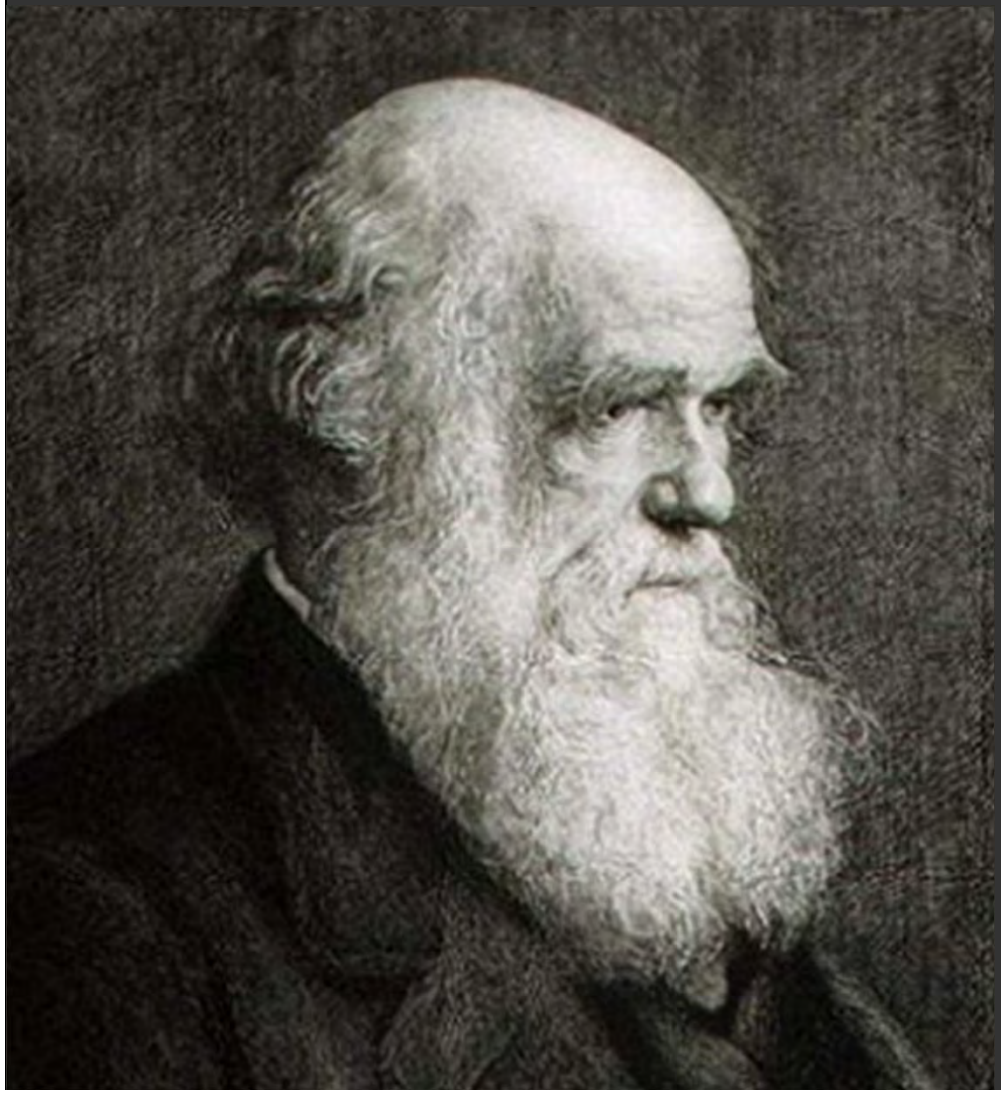
Many other fundamental issues:

- **Ensuring soundness of dynamic process changes**
- **Enabling adaptations based on model abstractions**
- **Providing proper end user assistance**
- **Balancing process flexibility and security**



Reichert, Manfred and Dadam, Peter and Bauer, Thomas (2003) *Dealing with forward and backward jumps in workflow management systems.* Int'l Journal Software and Systems Modeling (SOSYM), 2(1): 37-58

Process Evolution

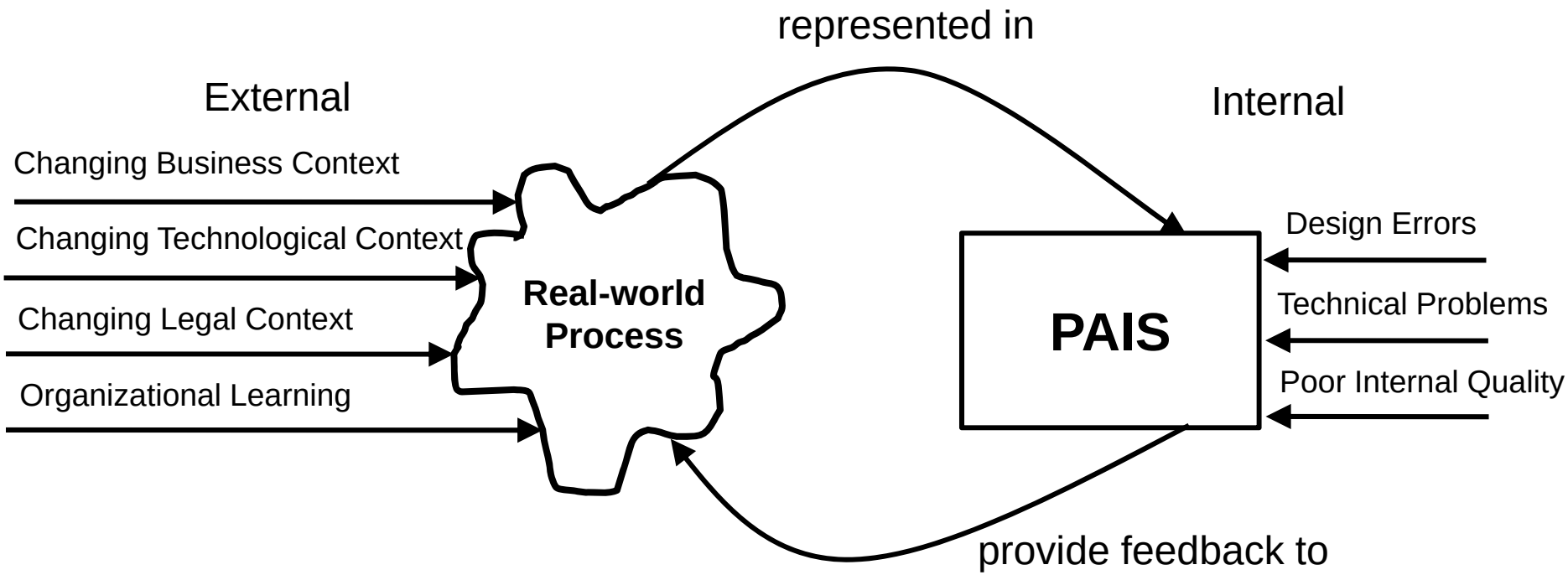


”It is not the strongest of the species that survives, not the most intelligent that survives. It is the one that is the most adaptable to change.“

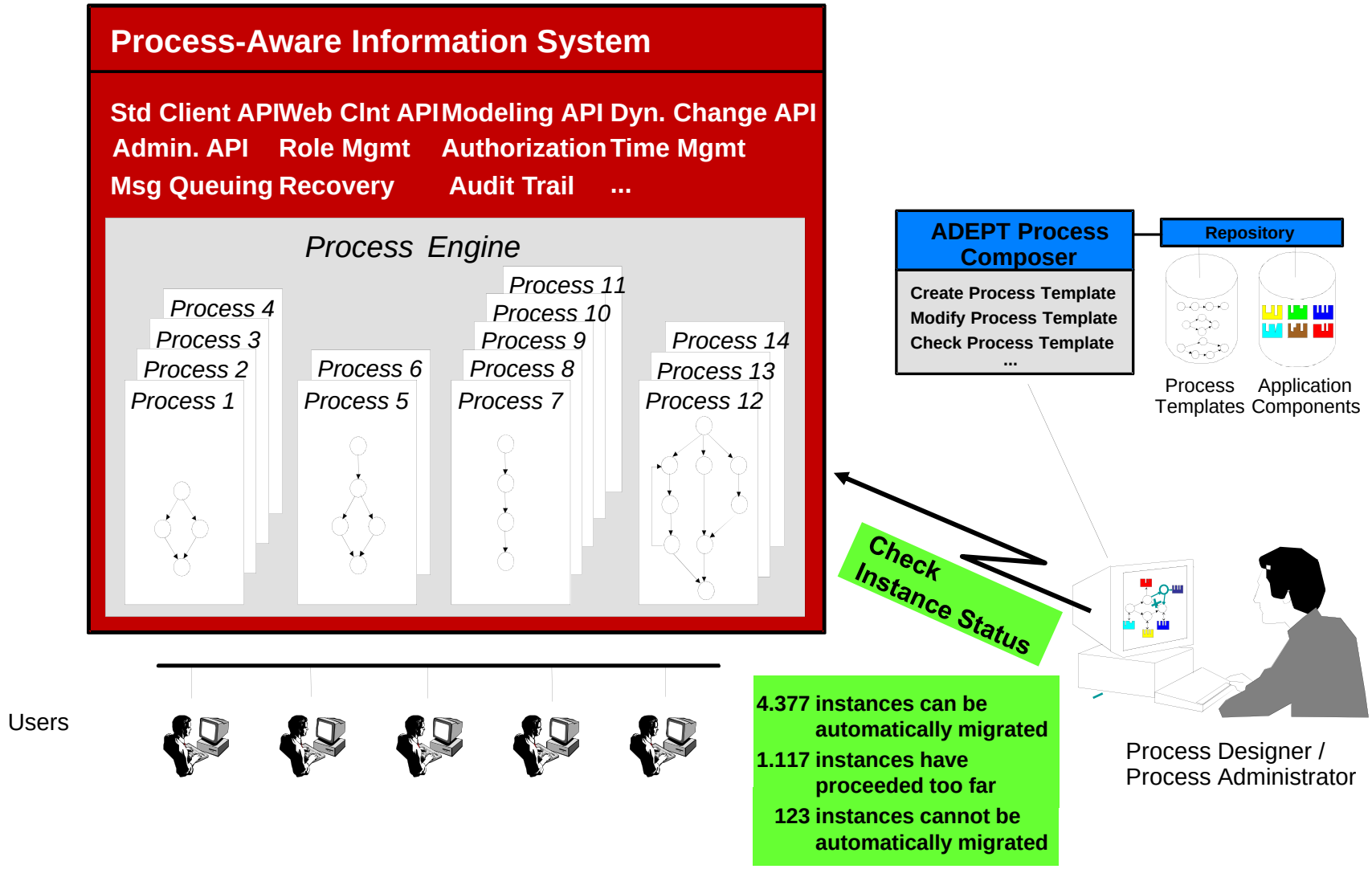
Charles Darwin

Flexibility Need: Evolution

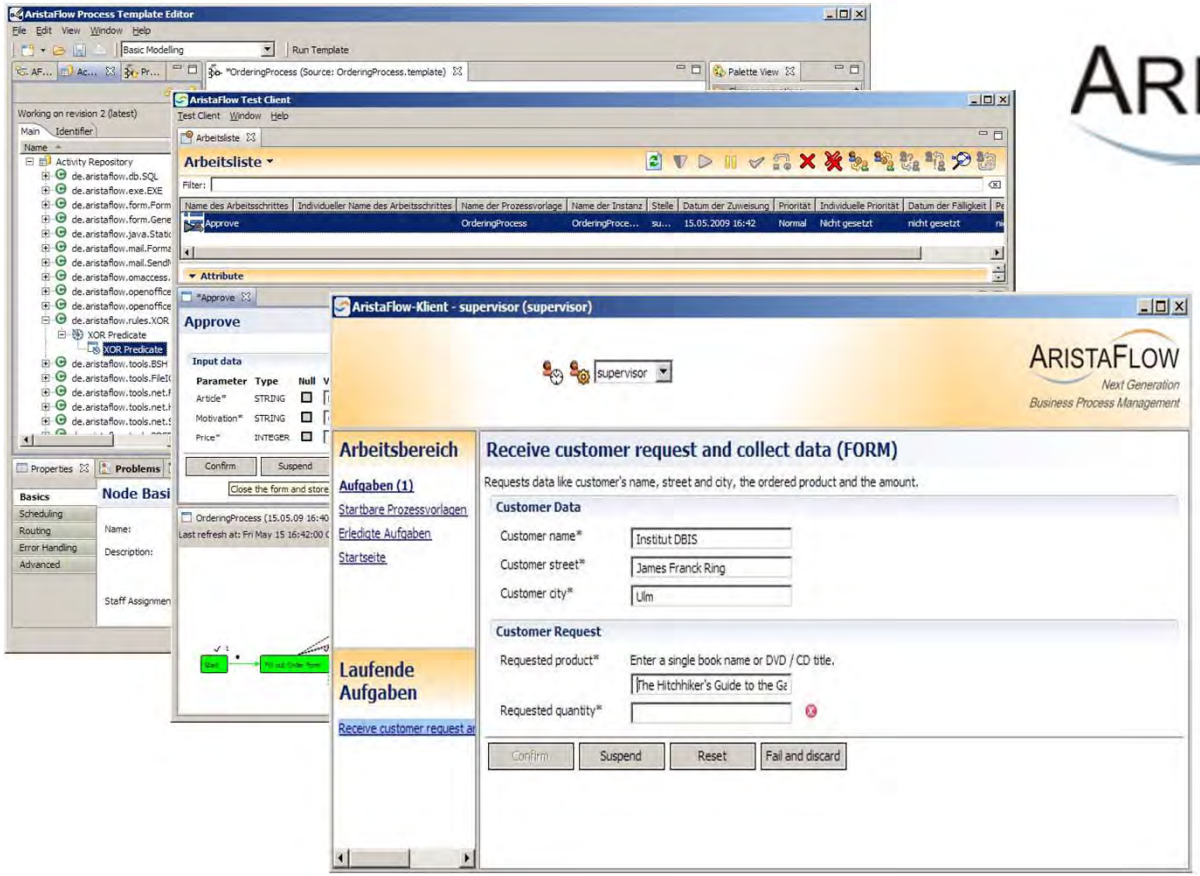
- Ability to change the implemented process when the business process evolves
- Drivers:



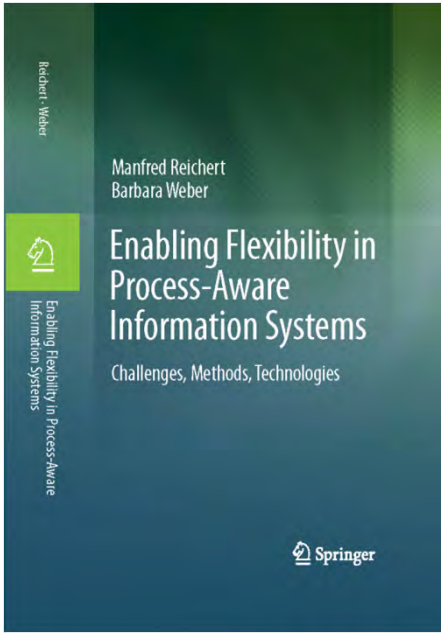
Process Evolution Support:
The User's View



Process Flexibility:
Transfering Research to Practice

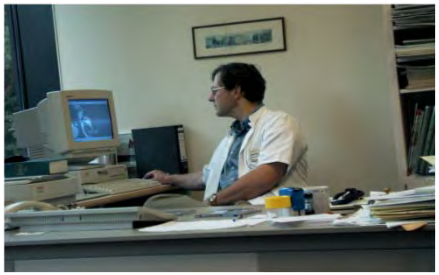


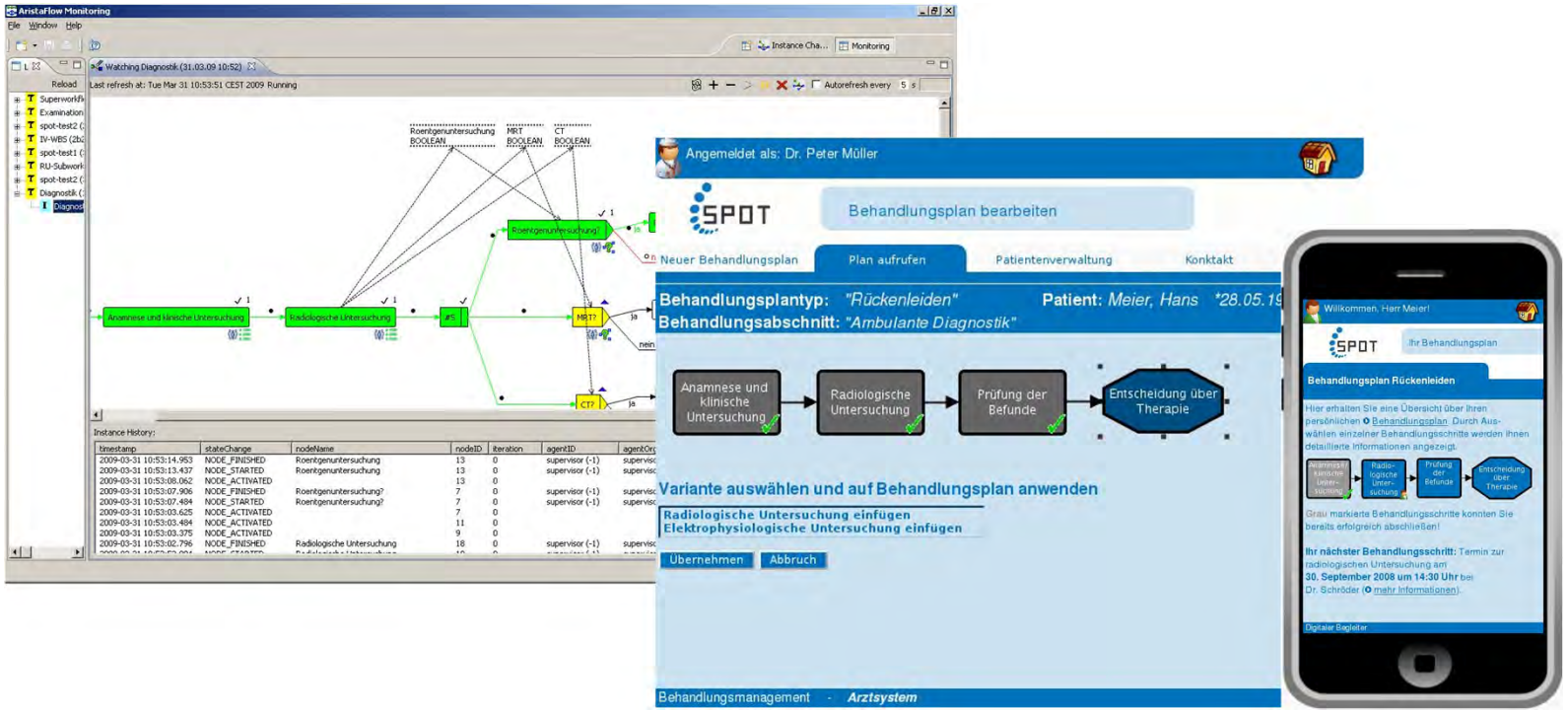
ARISTAFLOW



Reichert, M. et al. (2009) *Enabling Poka-Yoke Workflows with the AristaFlow BPM Suite.* In: CEUR Workshop Proceedings 489.

Process Flexibiltiy:
Clinical Pathway Support with AristaFlow BPM Suite

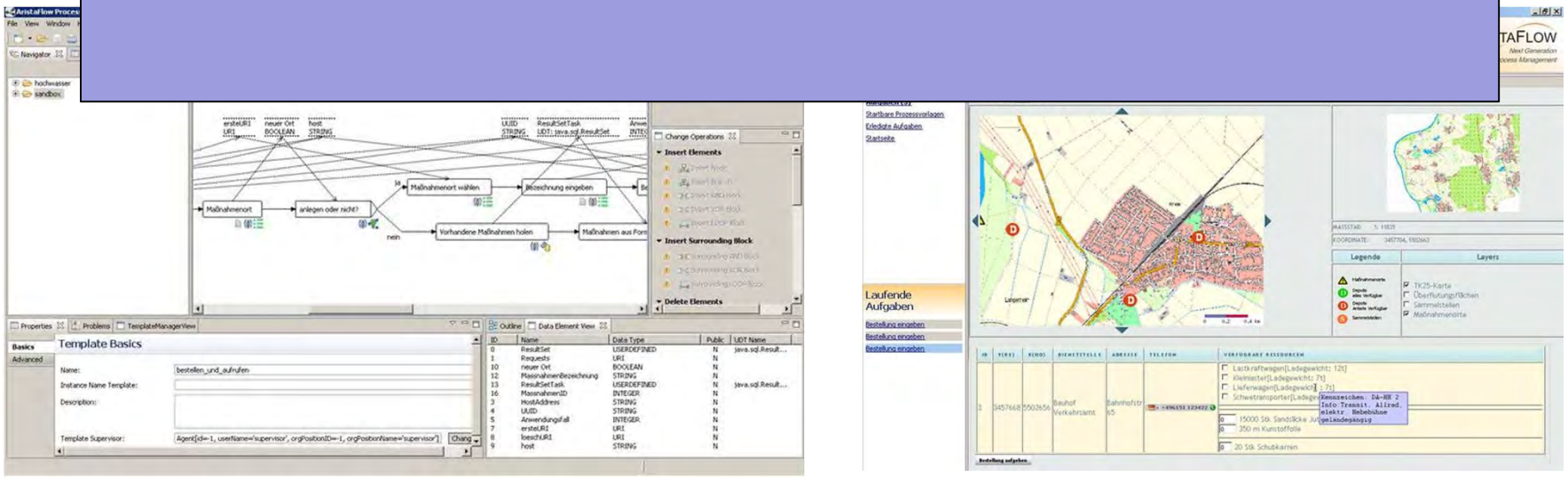




Process Flexibiltiy:
Disaster Management with AristaFlow BPM Suite

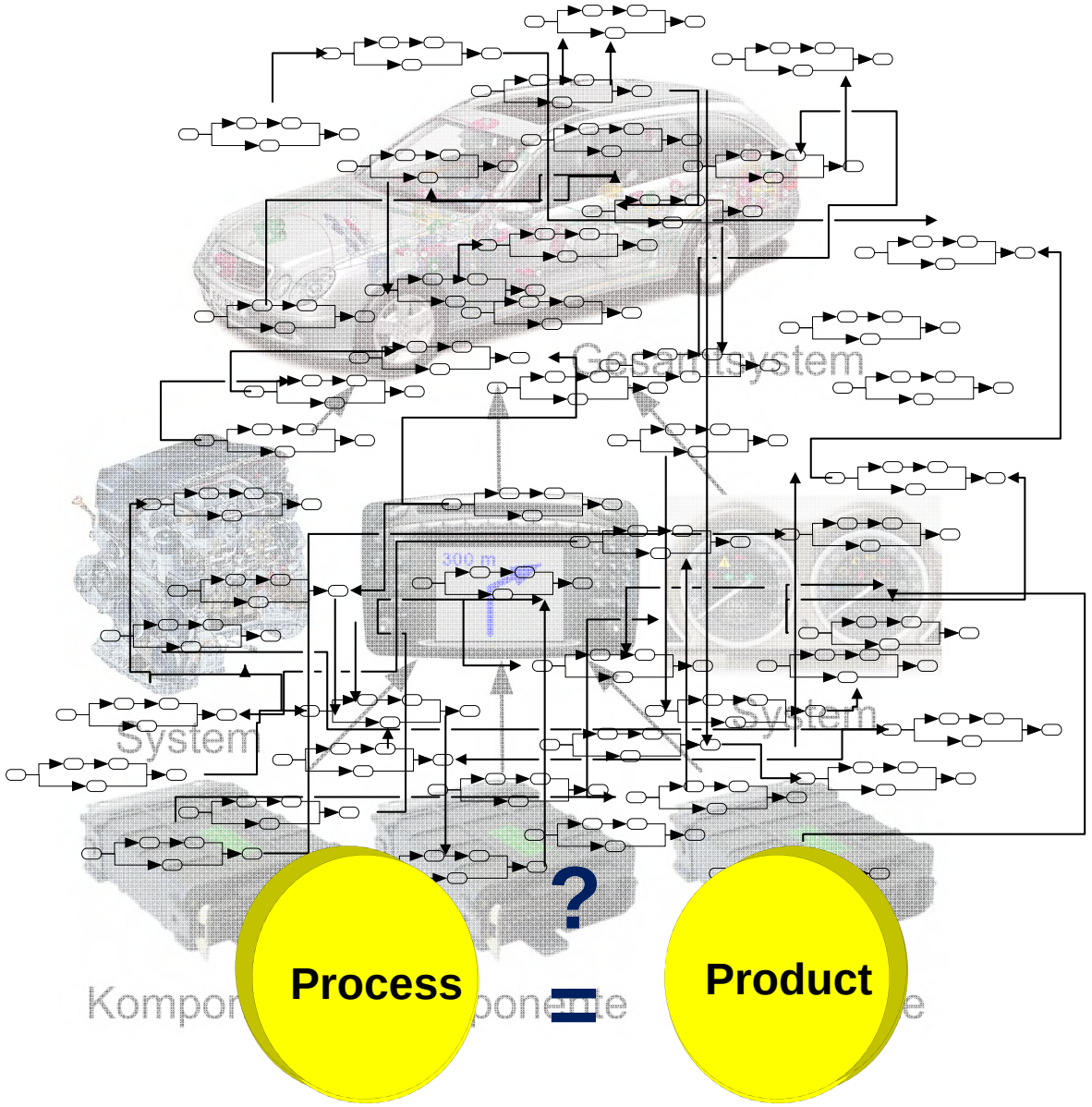
Process-aware, Cooperative Emergency Management for Water Infrastructures

Lessons Learned?



A. Wagenknecht; U. Rüppel: Improving Resource Management In Flood Response With Process Models and Web GIS. In: 16th TIEMS Conf., 2009

Big Processes: The Challenge



Big Processes: Drivers

Modeling

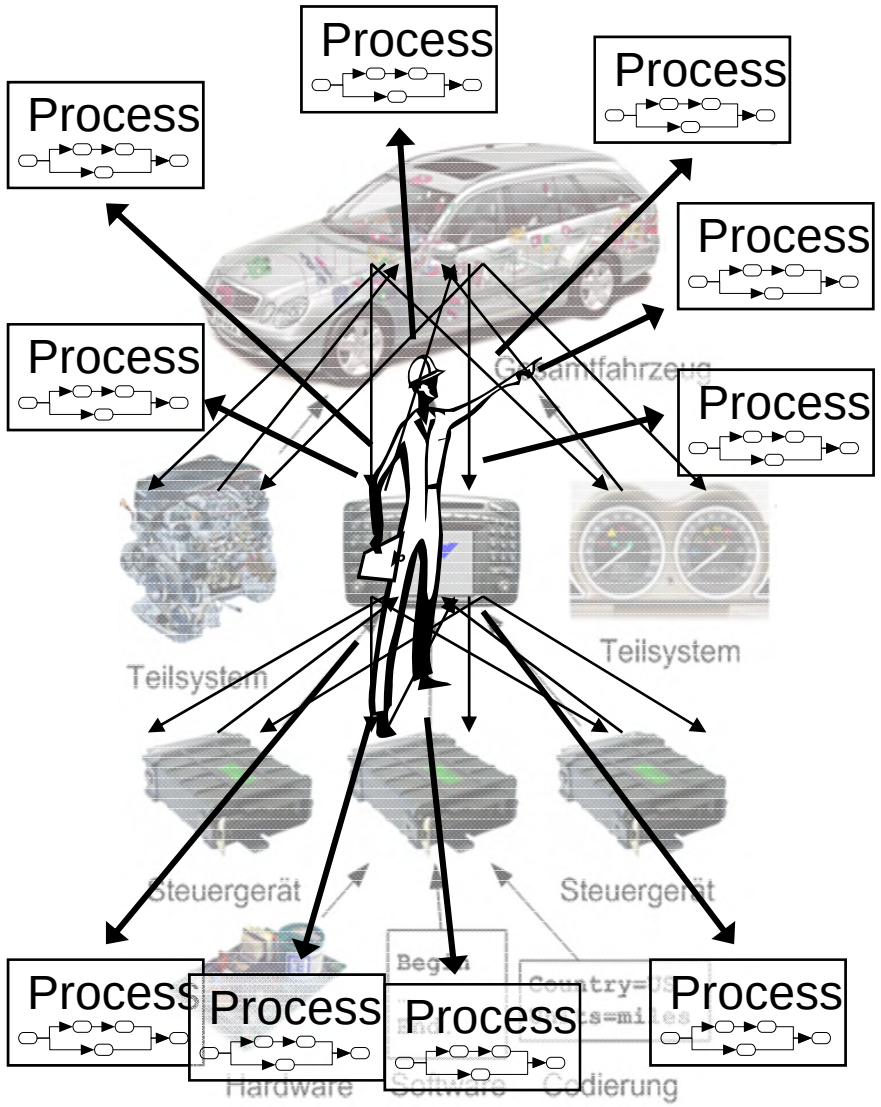
Execution

Dynamic Adaptation

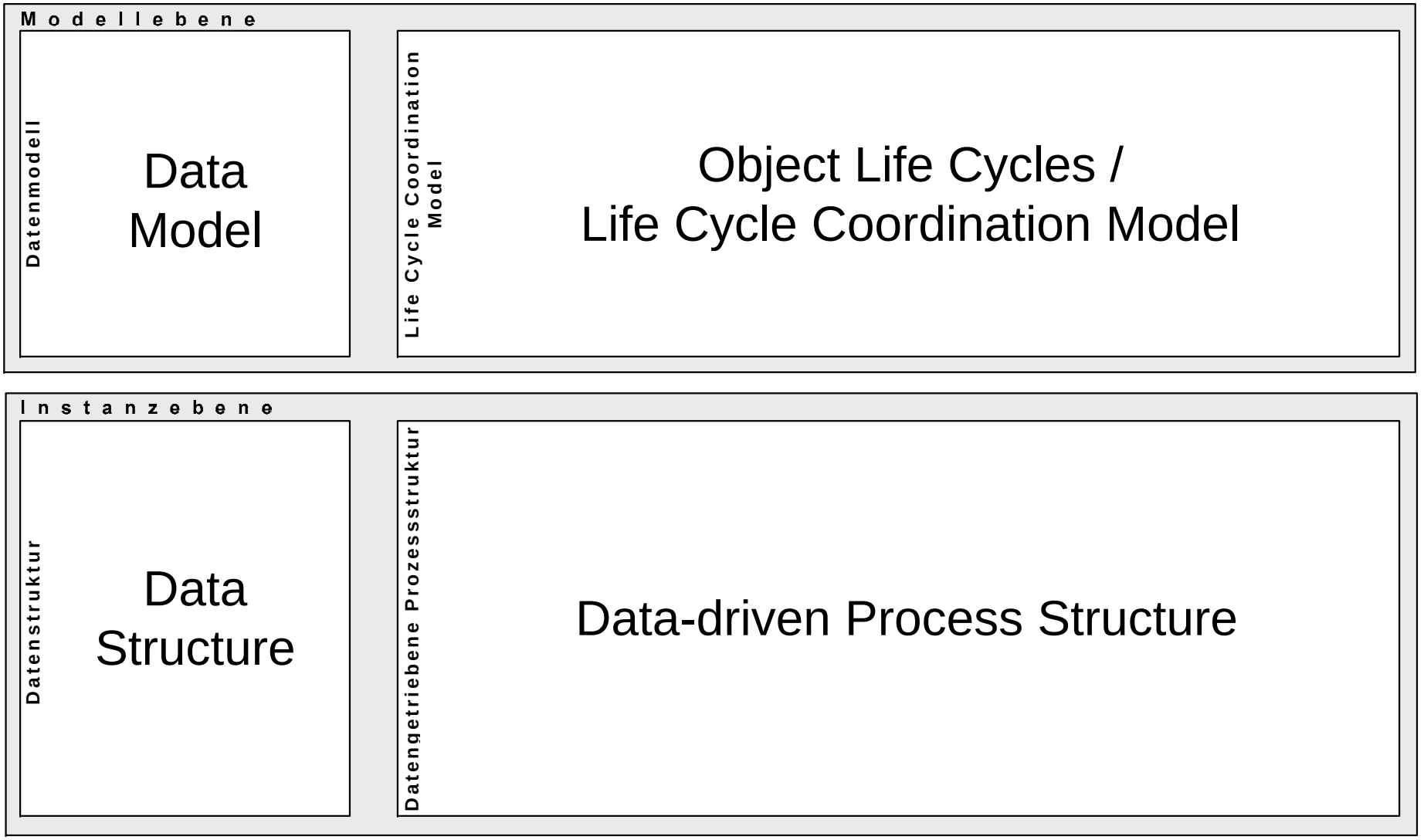
Exception Handling

Process

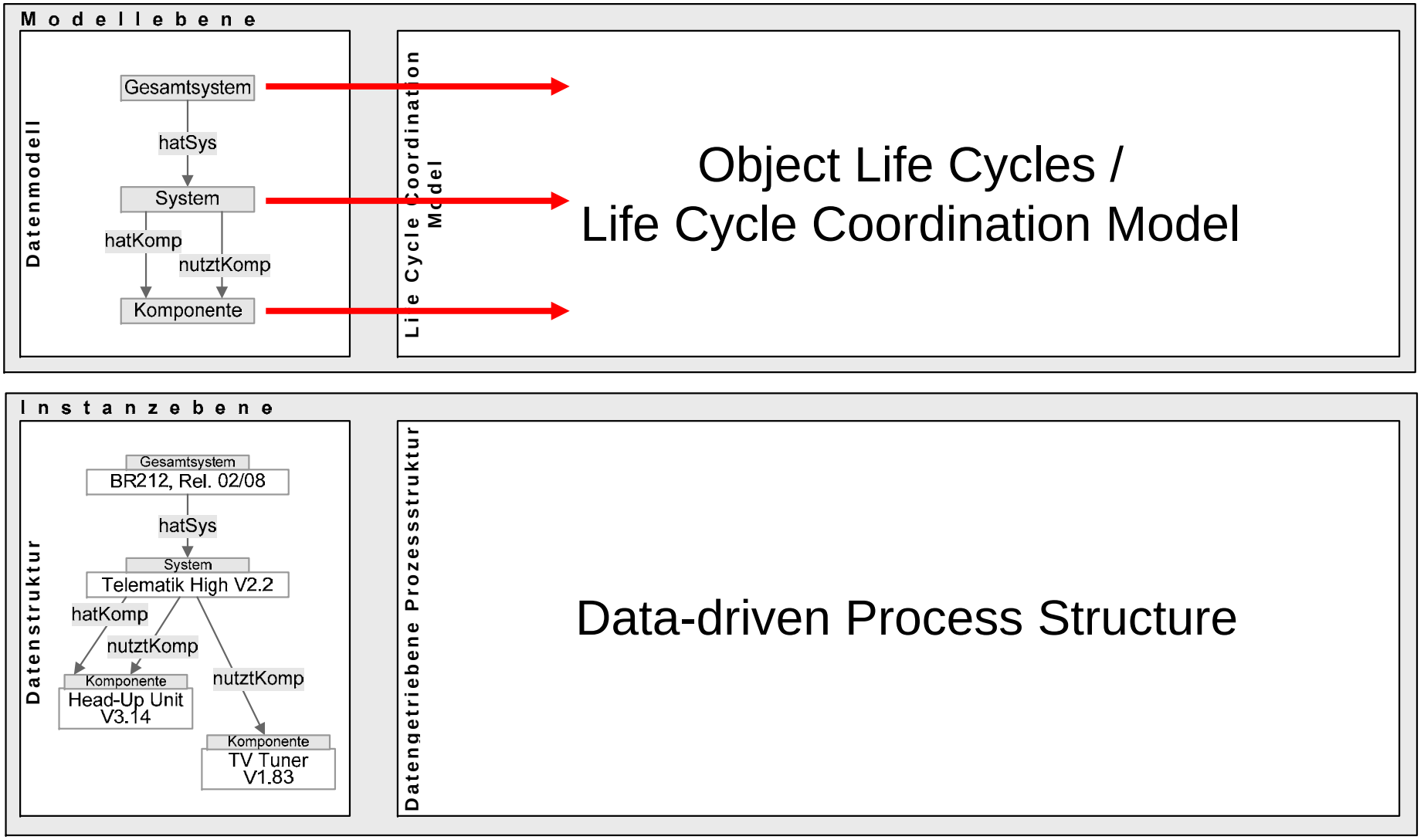
Product



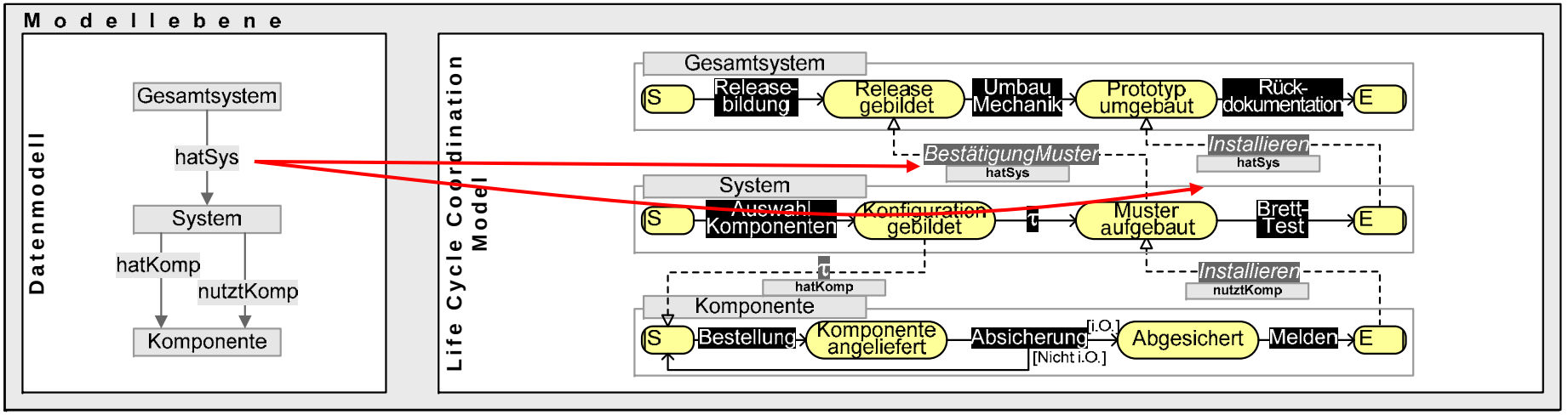
Big Processes: The Corepro Approach



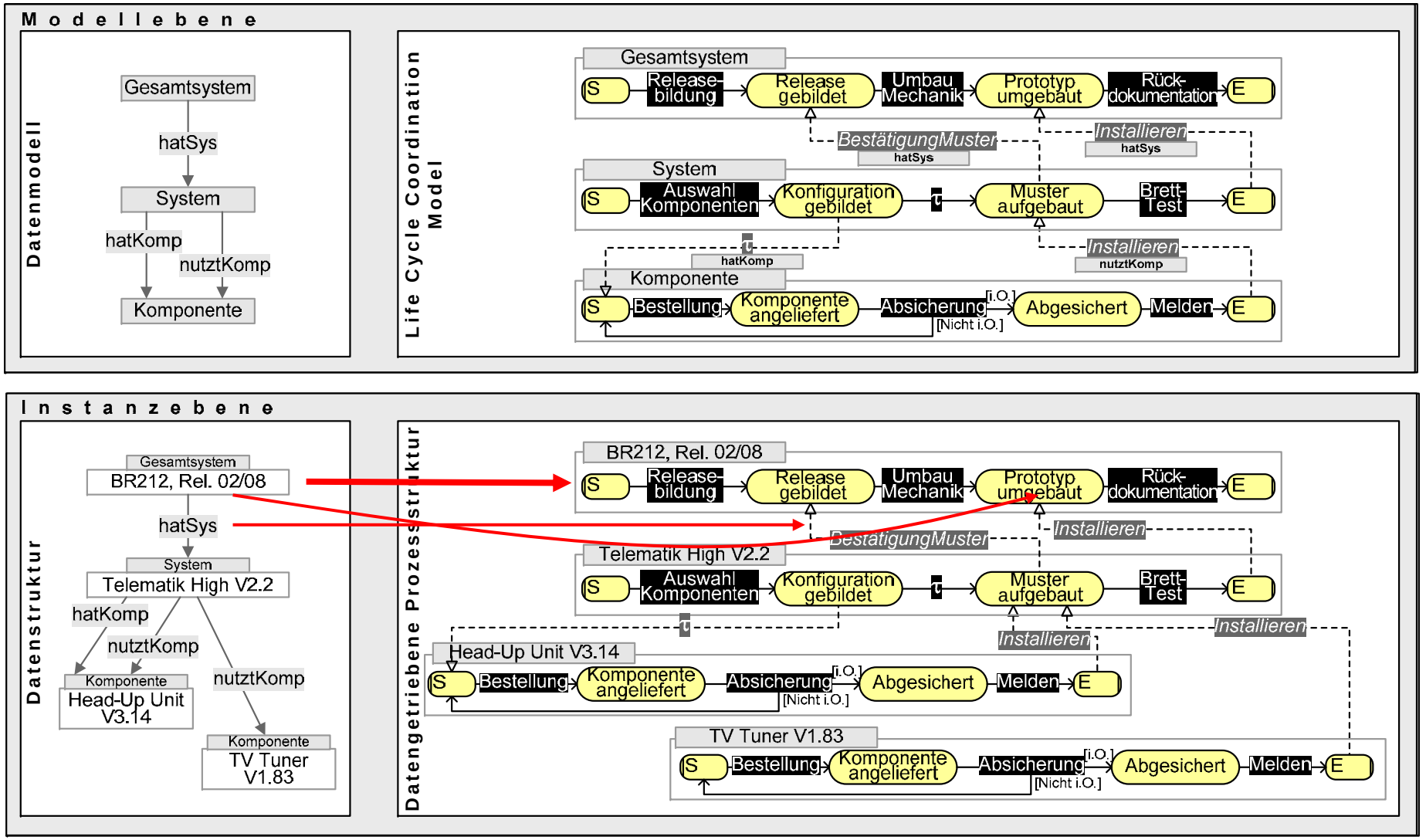
Big Processes: The Corepro Approach

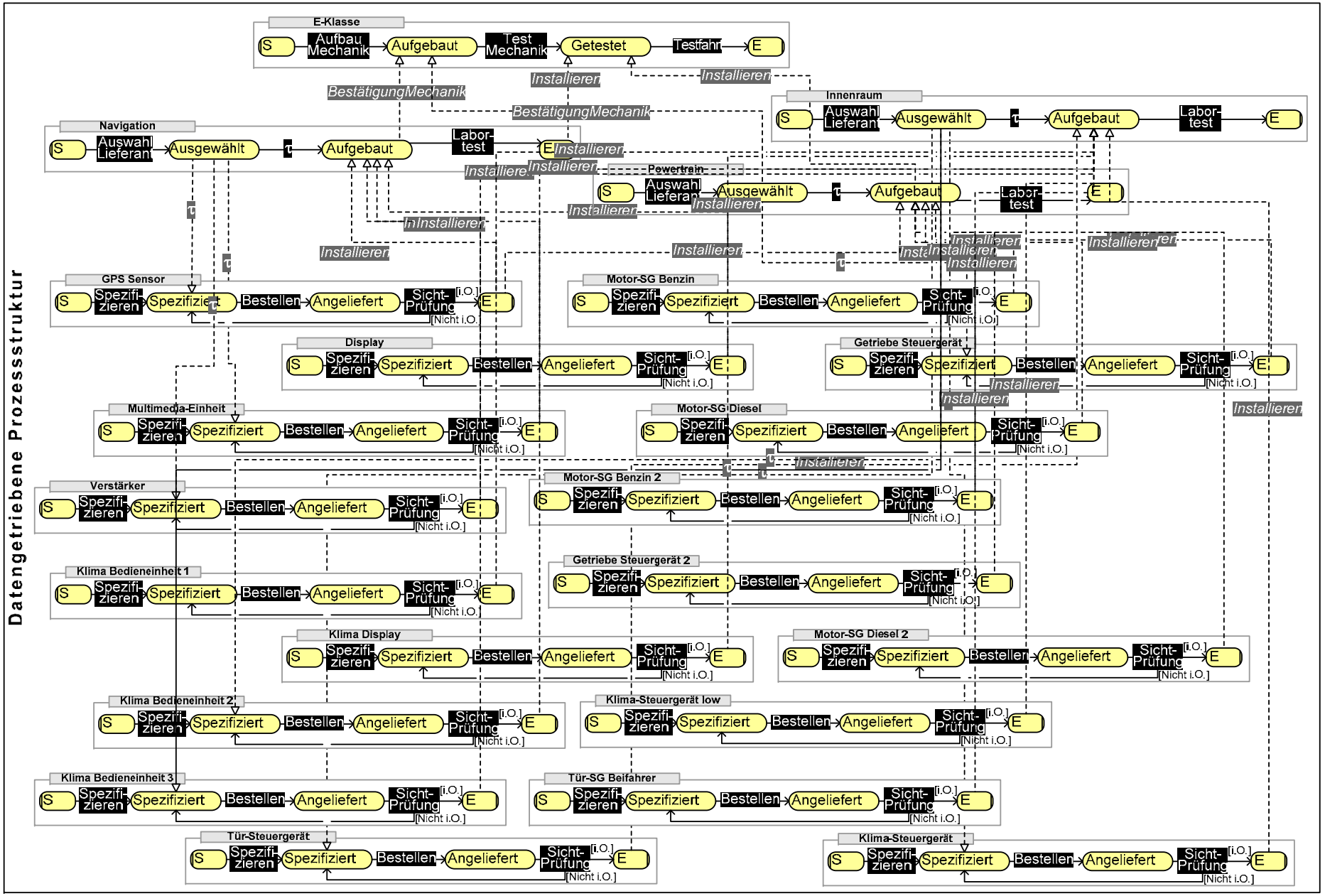


Big Processes: The Corepro Approach

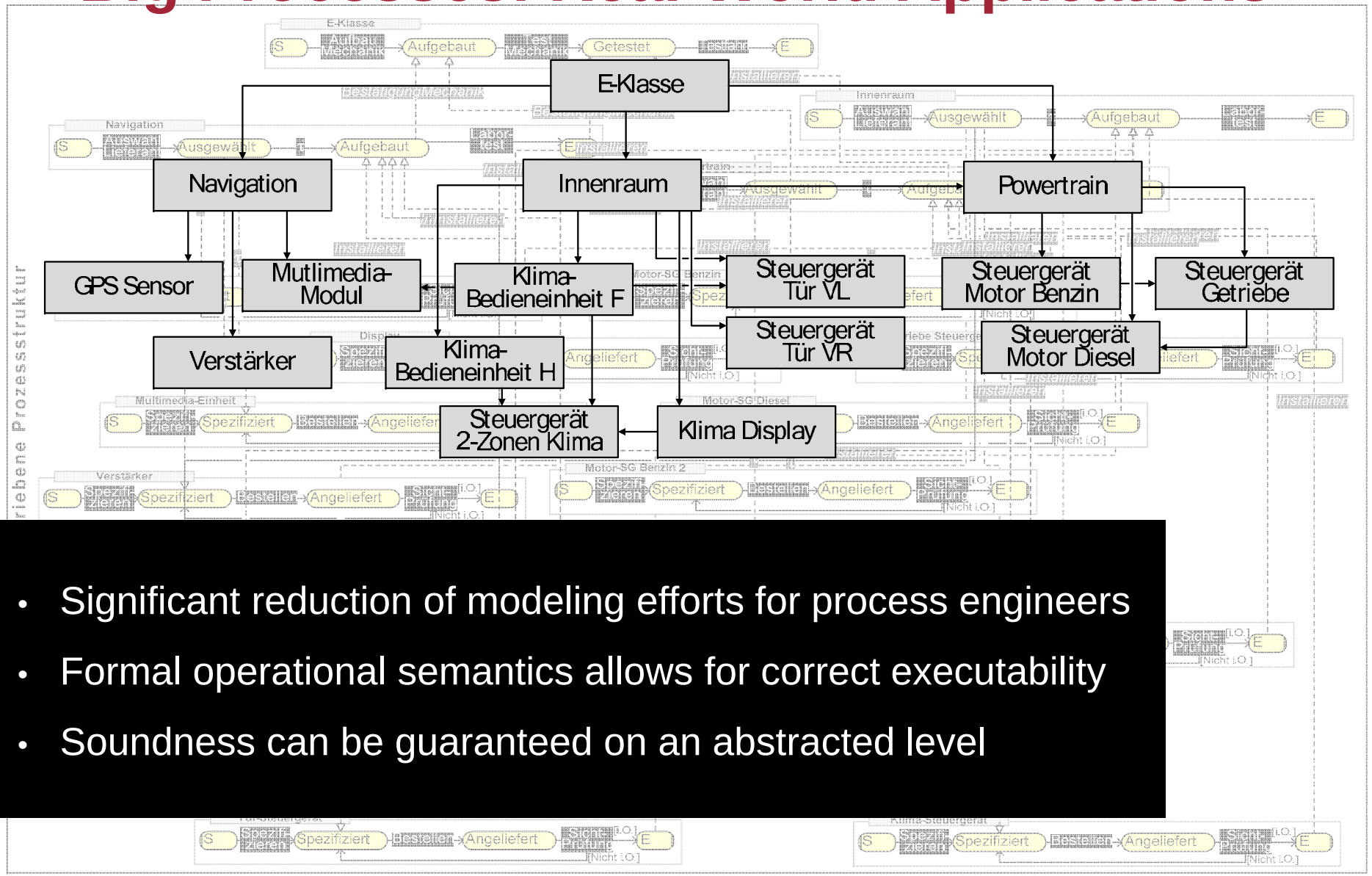


Big Processes: The Corepro Approach




Datengetriebene Prozessstruktur
E-Klasse
S
Aufbau Mechanik
Aufgebaut
Test Mechanik
Getestet
Testfahrt
E
BestätigungMechanik
Installieren
Navigation
Auswahl Lieferant
Ausgewählt
Aufgebaut
Labor-test
Powertrain
Innenraum
GPS Sensor
Spezifi-zieren
Spezifiziert
Bestellen
Angeliefert
Sicht-Prüfung
[i.O.]
[Nicht i.O.]
Motor-SG Benzin
Display
Getriebe Steuergerät
Multimedia-Einheit
Motor-SG Diesel
Verstärker
Motor-SG Benzin 2
Klima Bedieneinheit 1
Getriebe Steuergerät 2
Klima Display
Motor-SG Diesel 2
Klima Bedieneinheit 2
Klima-Steuergerät low
Klima Bedieneinheit 3
Tür-SG Beifahrer
Tür-Steuergerät
Klima-Steuergerät

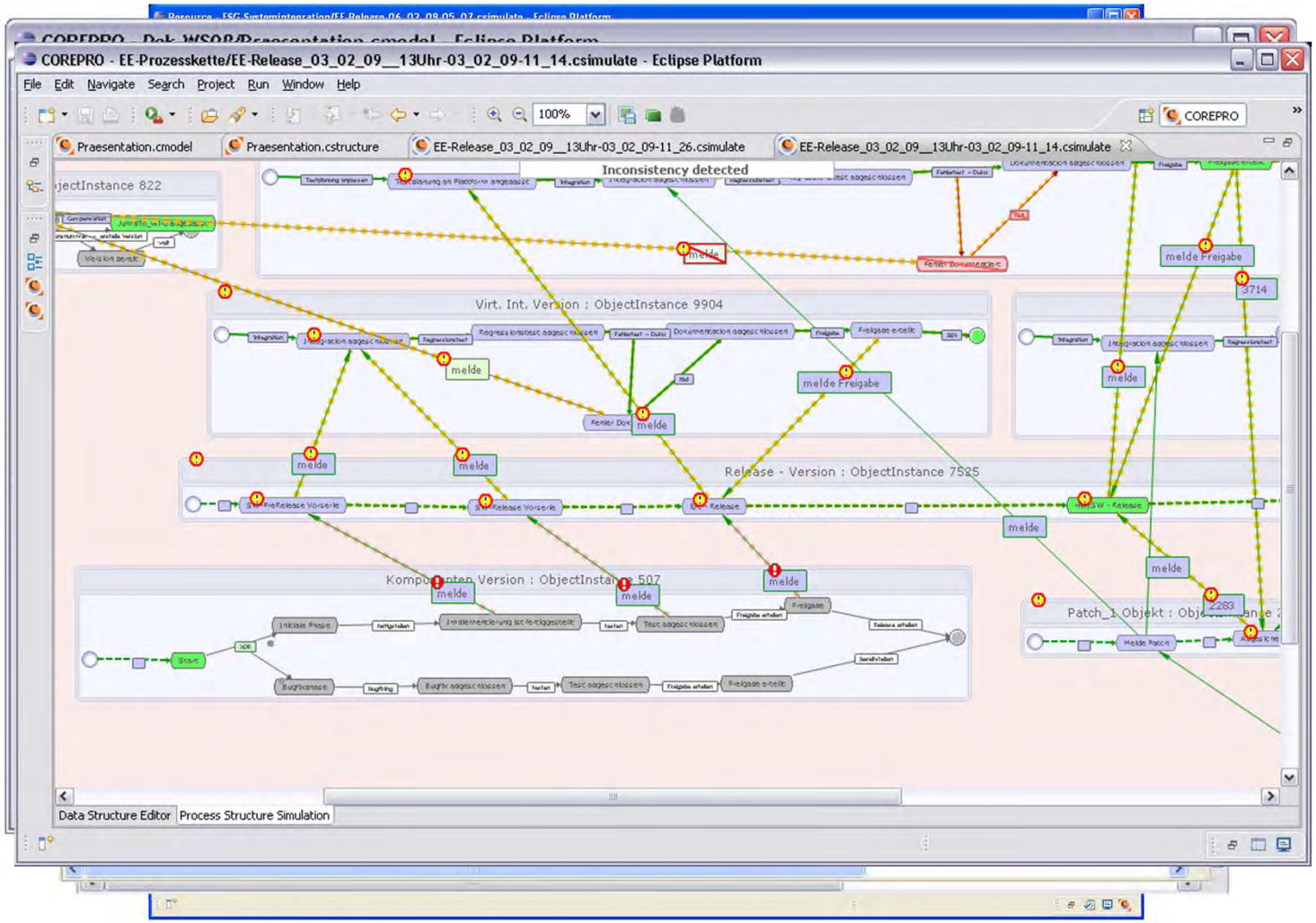
Big Processes: Real-World Applications



- Significant reduction of modeling efforts for process engineers
- Formal operational semantics allows for correct executability
- Soundness can be guaranteed on an abstracted level

Big Processes: The Corepro Approach

Au[illegible]sture




2005

BPM to Go:
Mobile Process and Task Support

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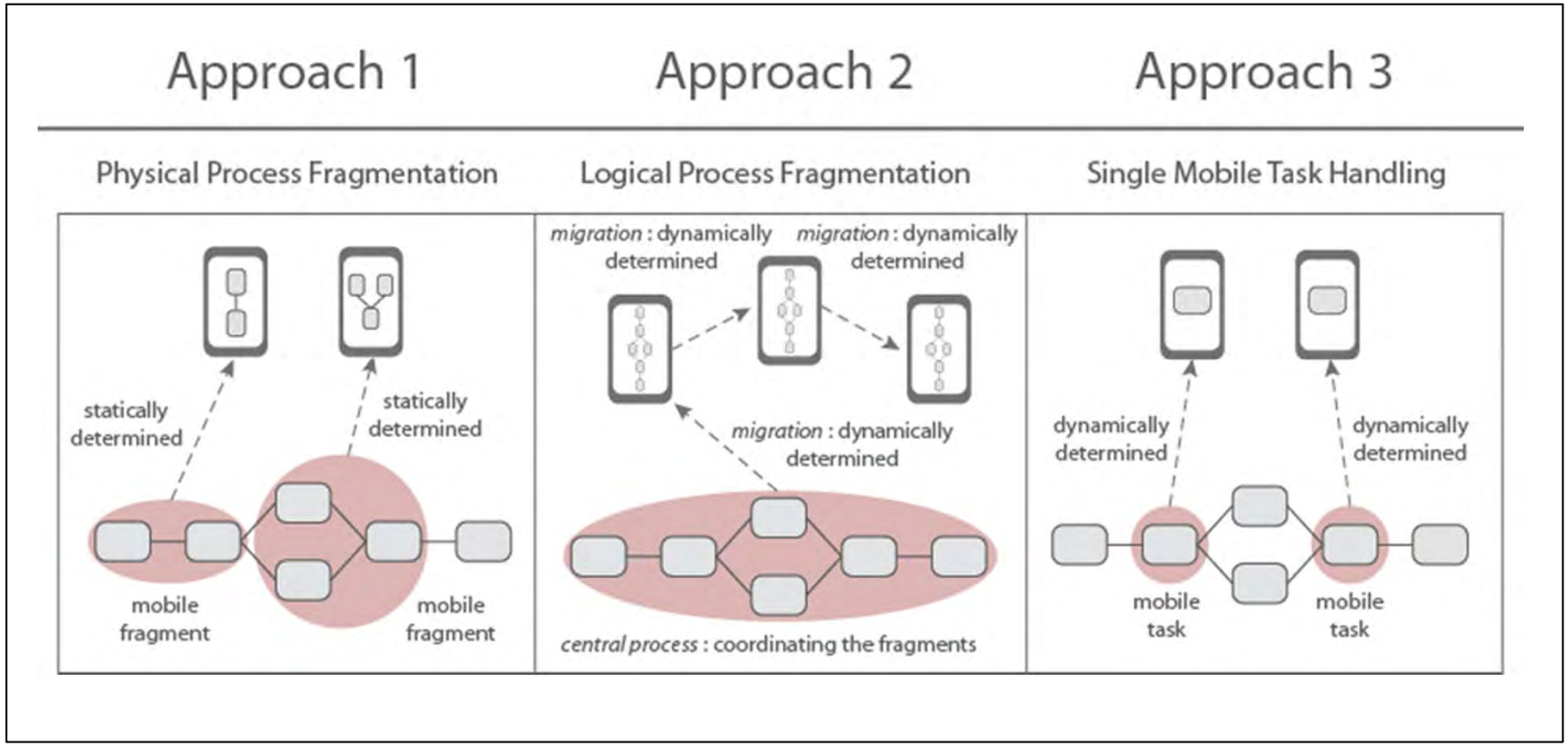
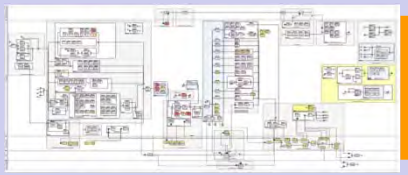
Mobile Process and Task Support



BPM to Go:
Mobile Process and Task Support

Process Management System

controls



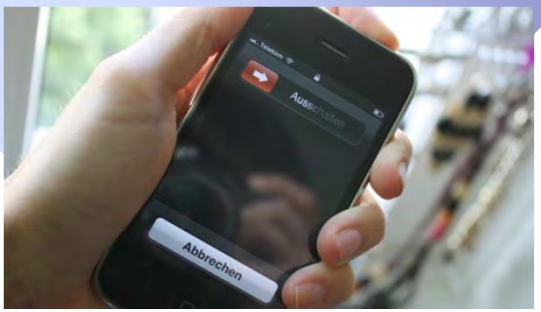
Context-specific execution of mobile activities, offline mode…

GSM, GPRS,UMTS
W-LAN

Assignment of mobile activities (protocol-based)

connection abortion, device error, user behavior, resources

Patient treatment

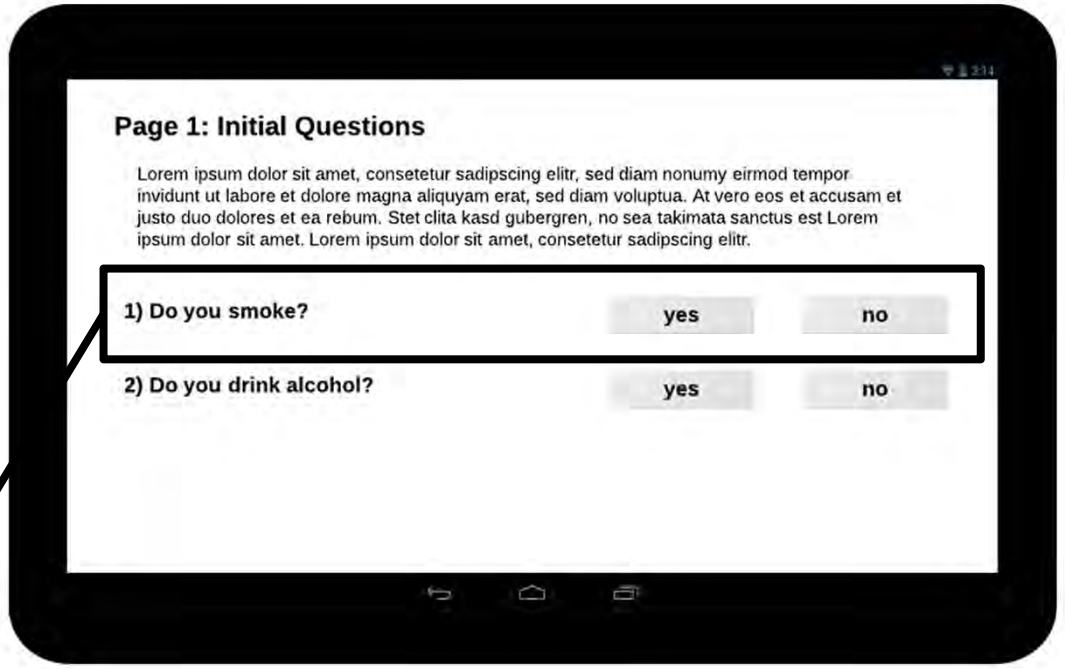


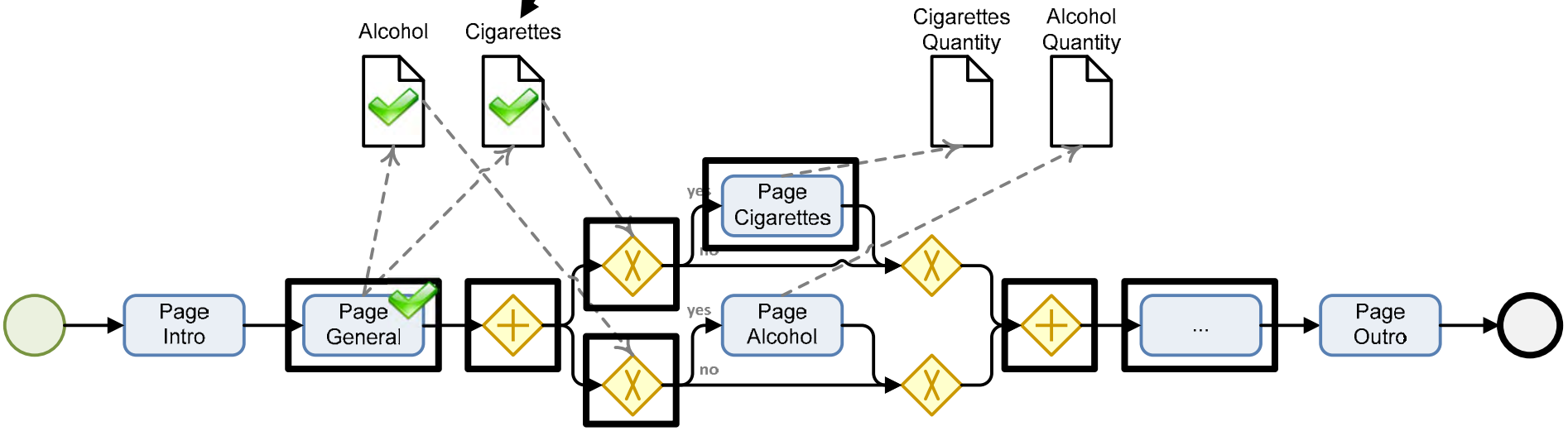
BPM to Go:
MeDo – Mobile Process Support for Ward Rounds

Pryss R., Mundbrod N., Langer D., Reichert M. (2014) Supporting medical ward rounds through mobile task and process management. Inf Sys and e-Business Management, Springer.

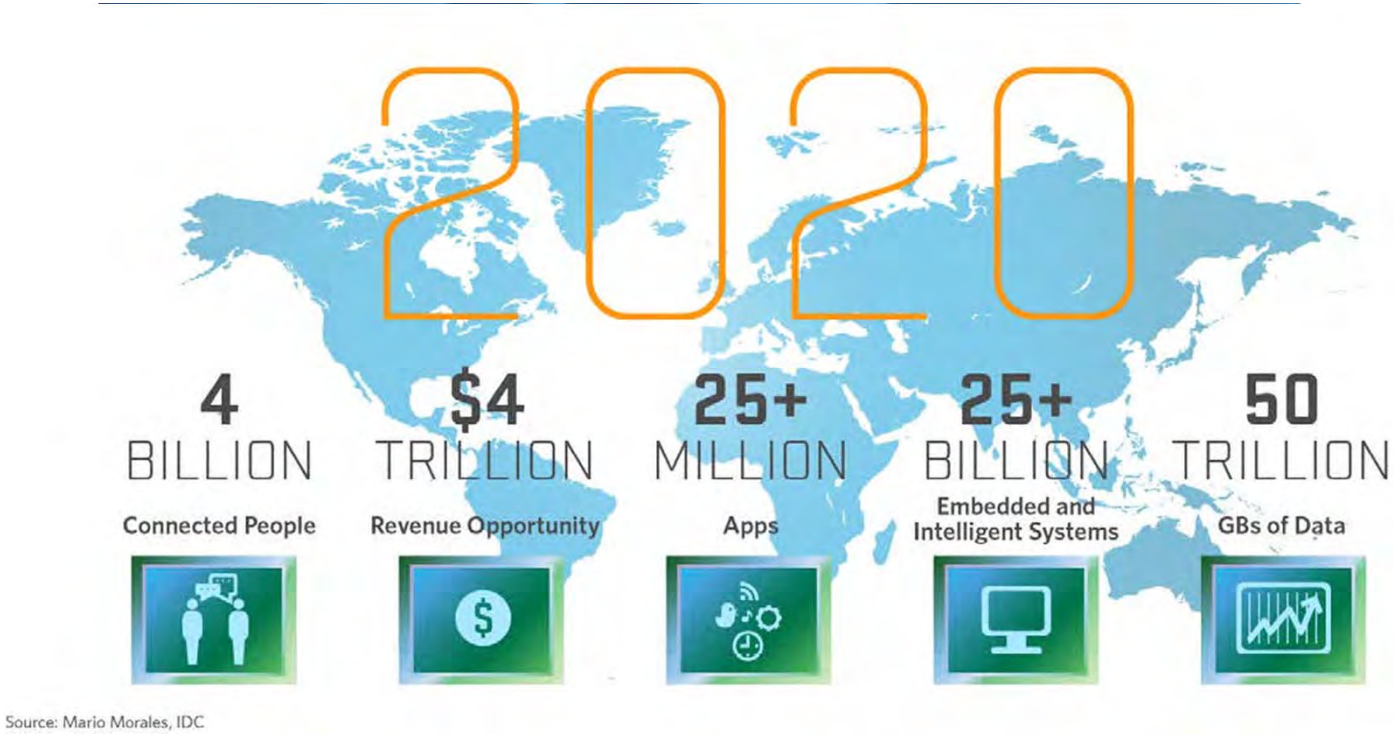
BPM to Go in a Broader Context:

Process-Driven Mobile Questionnaires



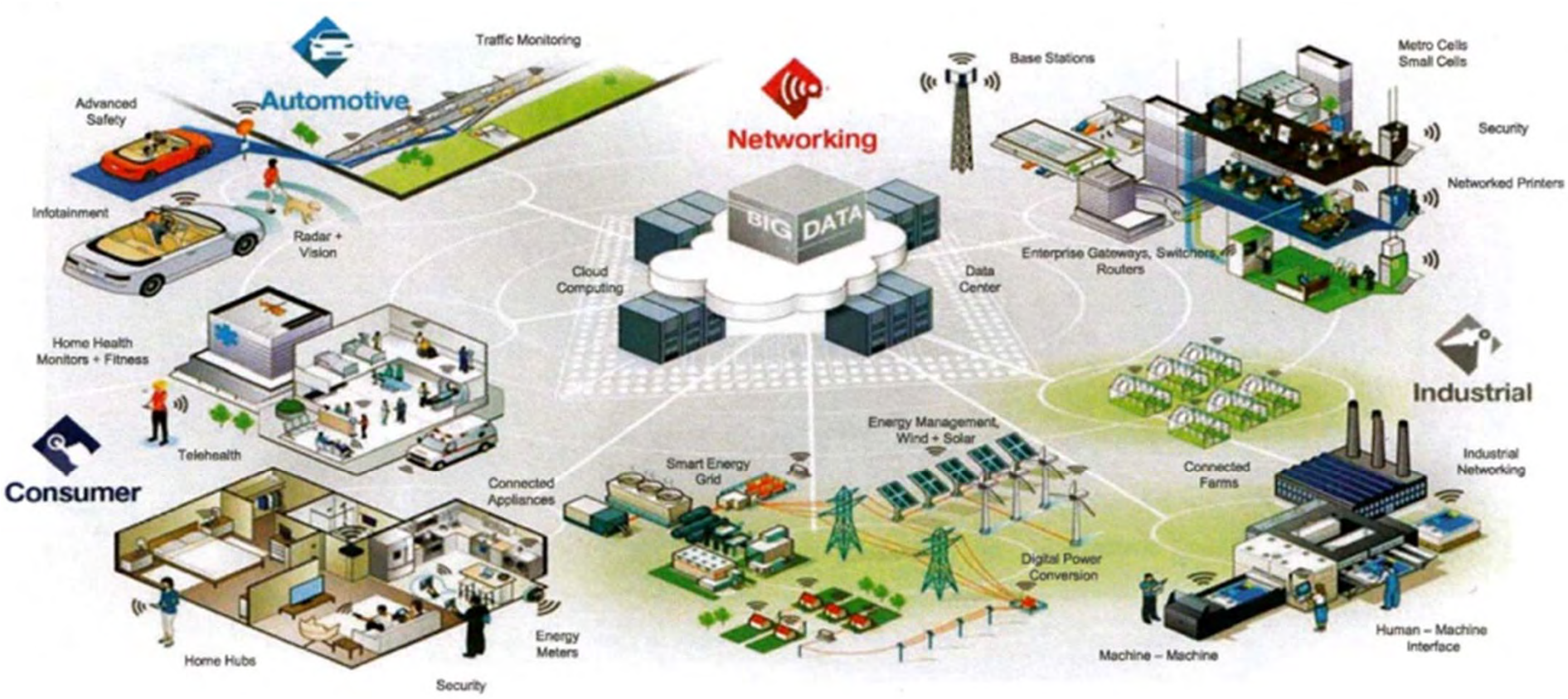


BPM and the Internet of Things
Smart Processes in the Cloud

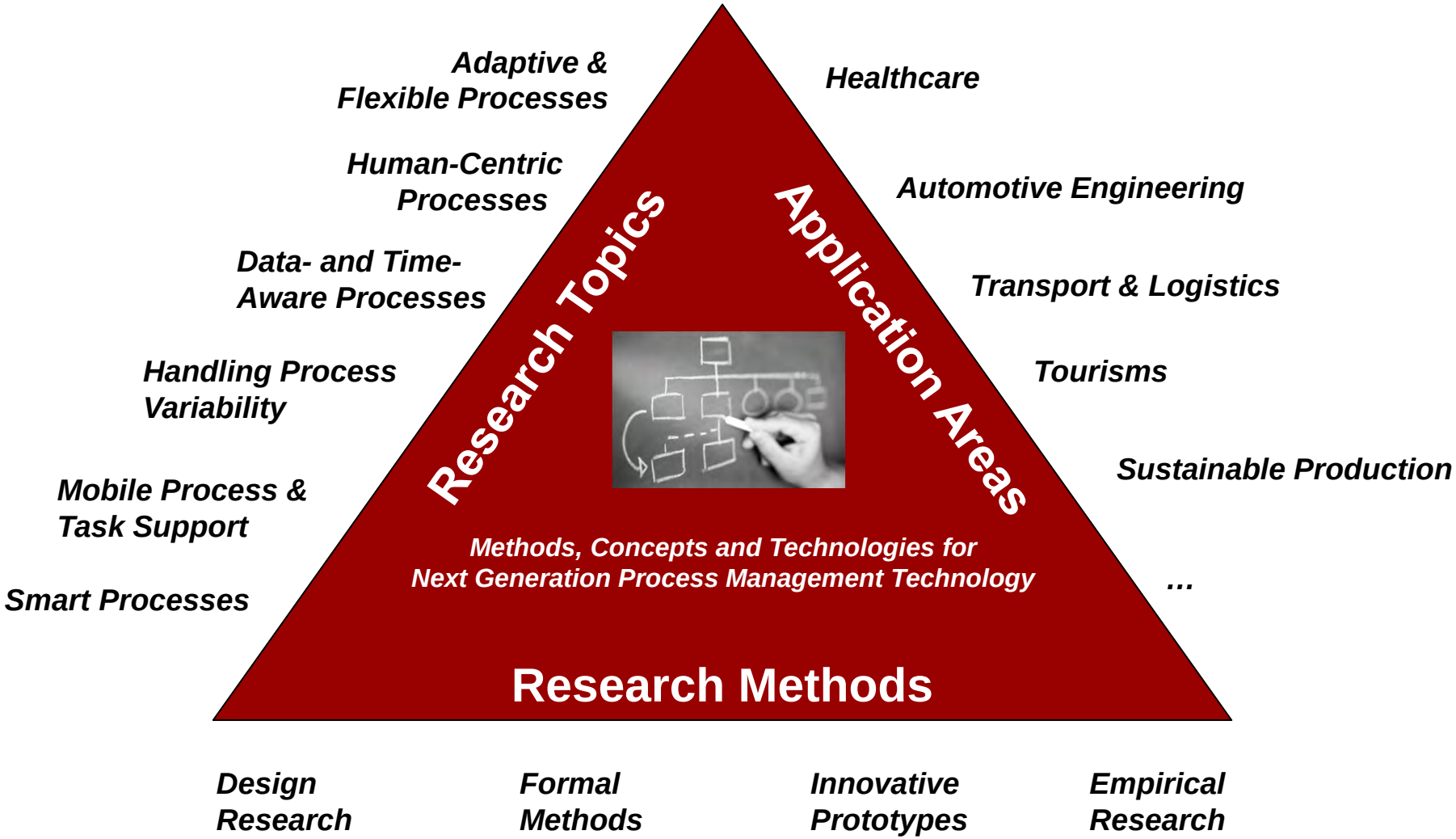


Source: Mario Morales, IDC

BPM and the Internet of Things
Smart Processes in the Cloud



Process Science at Ulm University




Thank you!